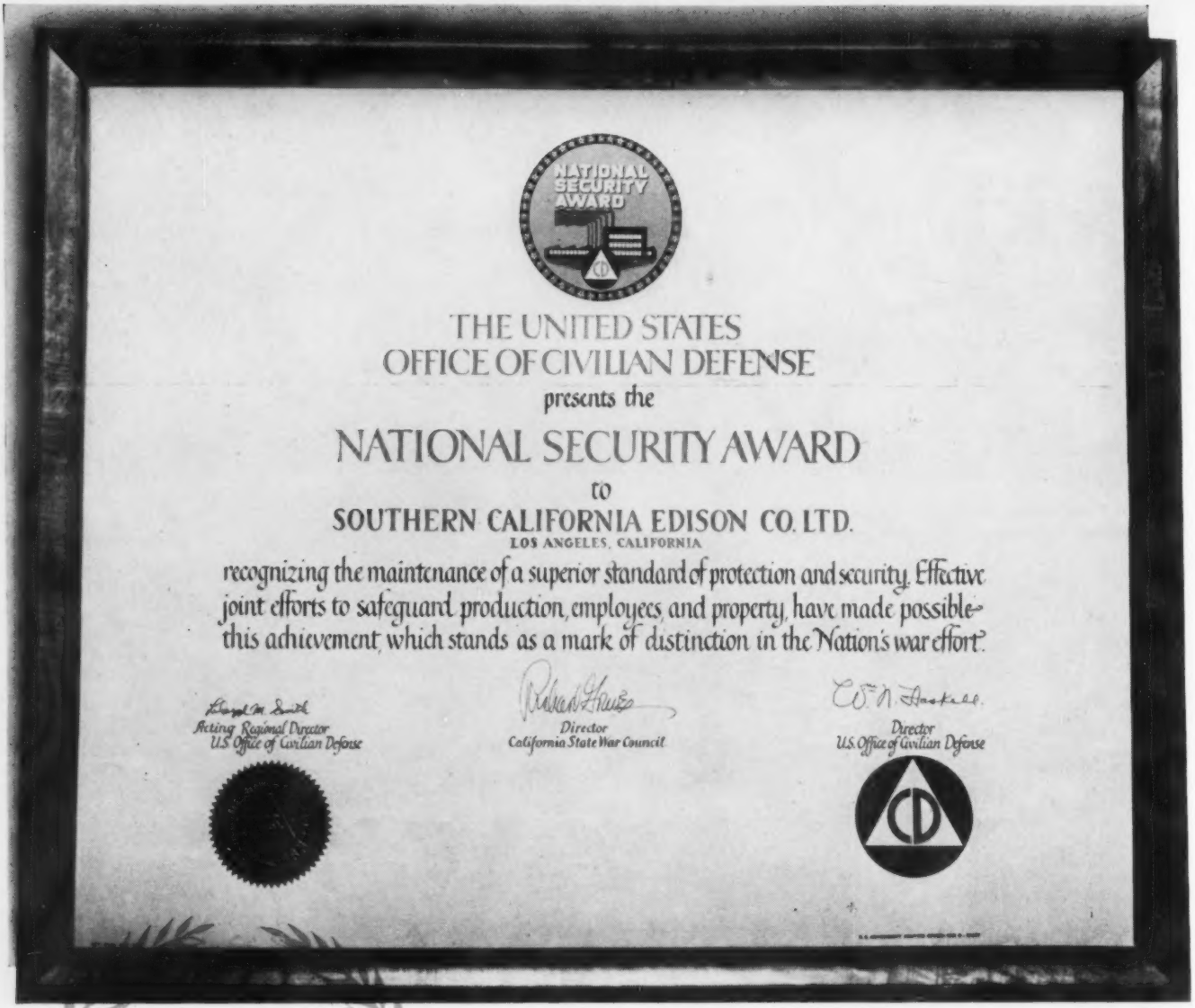
ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED SECTION OF THE U. S.

ANNUAL LIGHTING ISSUE

SEPTEMBER 1944
25c A COPY


NATIONAL SECURITY AWARD
THE UNITED STATES
OFFICE OF CIVILIAN DEFENSE
presents the
NATIONAL SECURITY AWARD
to
SOUTHERN CALIFORNIA EDISON CO. LTD.
LOS ANGELES, CALIFORNIA
recognizing the maintenance of a superior standard of protection and security. Effective joint efforts to safeguard production, employees, and property, have made possible this achievement, which stands as a mark of distinction in the Nation's war effort.
Director
California State War Council
Director
U.S. Office of Civilian Defense

EDISON COMPANY WINS SECURITY AWARD

The United States Office of Civilian Defense has presented Southern California Edison Company with the National Security Award. This award is in recognition of Edison's contribution to the security and protection of not only its own important war-time facilities, but the public as well. Edison's protective program, developed in connection with civilian defense organizations, comprises employee training, private telephone lines reaching every part of the company's system, fire brigades, plant inspections and other special wartime measures.

SOUTHERN CALIFORNIA EDISON COMPANY LTD

ELECTRICAL WEST (with which is consolidated The Journal of Electricity), September, 1944. Vol. 93, No. 3. Published monthly by the McGraw-Hill Company of California, 68 Post Street, San Francisco, 4, Calif. Entered as second class matter at the post office at San Francisco under the Act of March 3, 1879. Additional entry as second class matter at the post office at Los Angeles. Printed in U. S. A. Subscription rate in U. S. and U. S. possessions, Canada and Pan-America, $2 per year; all other countries, $3 gold. Single copy 25c.
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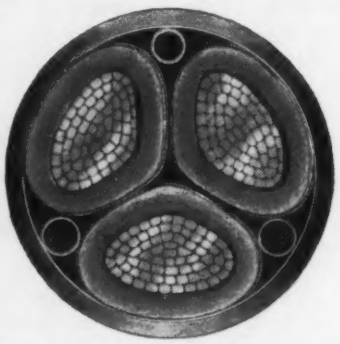
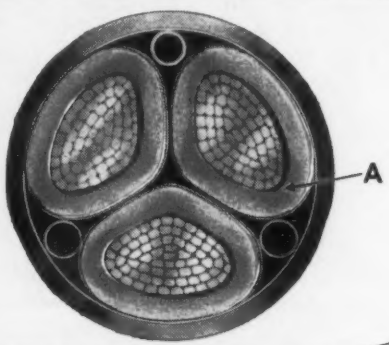
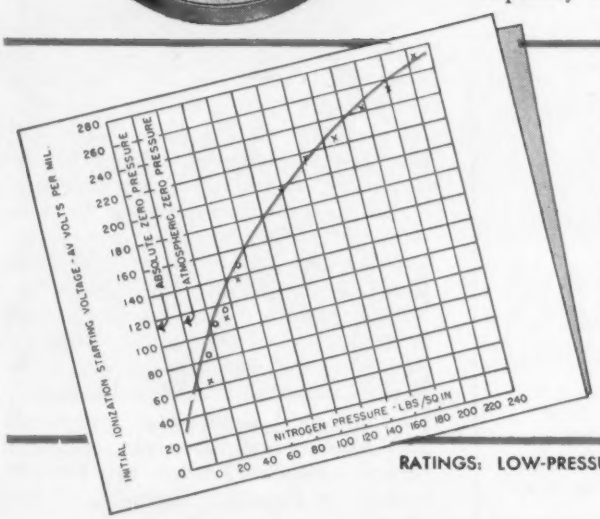
How "AUTOMATIC GRADING" adds to the strength of G-E mass-impregnated gas-filled cable



CONTROLLED GAS PRESSURE begins its contribution to this strong, self-protected cable right at the treating tank. After impregnation, drainage of surplus compound takes place in a regulated atmosphere of nitrogen gas, until a capillary balance is reached. Under these conditions, more compound is held in the inner zone near the conductor than in the outer zone. Significantly, as the red shading of the cross-section shows, this distribution of compound corresponds to the distribution of electrical stress outward from the conductor.



UNDER VOLTAGE STRESS, a further strengthening effect occurs. In G-E gas-filled cable, the impregnating compound is carefully selected to be sufficiently viscous to stay in place without bleeding freely, and yet be sufficiently mobile to be moved by electrostatic action. Voltage stress acts by electrostatic attraction to draw this mobile compound into the voids and butt spaces where the stress is greatest, rearranging the distribution of the compound in the cable cross-section so that all critical points of high stress (such as at sector edges A) are strengthened. The combined effect of capillary action and voltage stress is called *automatic grading*.



THE SAFE LIMITS of a cable's dielectric strength are indicated by persistence of ionization. In G-E gas-filled cable, however, incipient ionization is (1) *suppressed* by the controlled pressure (see chart), and (2) *self-extinguished* by automatic grading and by an effect known as "self-healing action" from "X-wax" formation.

The self-supervising feature, which warns of sheath damage, and this *self-protecting ability* help explain why we regard mass-impregnated gas-filled cable as tomorrow's universal cable-type, within its recommended voltage range. ***General Electric Company, Schenectady 5, N. Y.***

RATINGS: LOW-PRESSURE TYPE, 10 TO 40 KV; MEDIUM-PRESSURE TYPE, 40 TO 69 KV

GENERAL ELECTRIC

501-23-1200

BUY ALL THE BONDS YOU CAN—AND *KEEP* ALL YOU BUY

ELECTRICAL WEST

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Cover photo: Navy training blimps in hangar at Moffet Field, California.

CHANGE OF ADDRESS

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Electrical West,
68 Post St.,
San Francisco 4, Calif.

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From .....

To .....

Signed .....

People

Harold Rankin

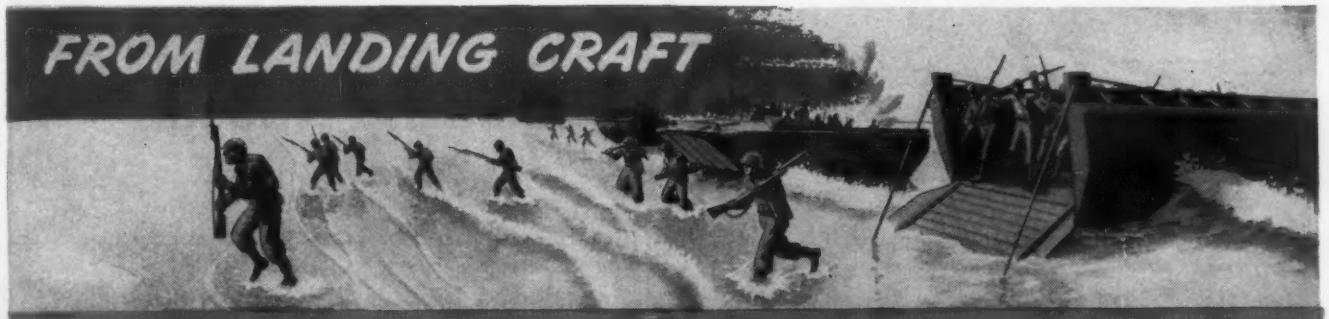
who writes of Denver's street lighting, p. 65, started with Public Service Co. of Colorado in 1920, while a student at the University.

A meter tester during school days, after graduation, he went to work for Public Service as a domestic salesman; in 1924 he was transferred to commercial lighting; in 1925 became superintendent of the wiring and fixture department. In 1927, he began his present work as lighting department superintendent. Under his direction, the utility introduced the first mercury-vapor street lighting in 1937 and now has, in Denver, approximately one-third of such street lighting units in the U. S. Other Rankin "firsts" are utility promotion of neon signs and of fluorescent lighting.

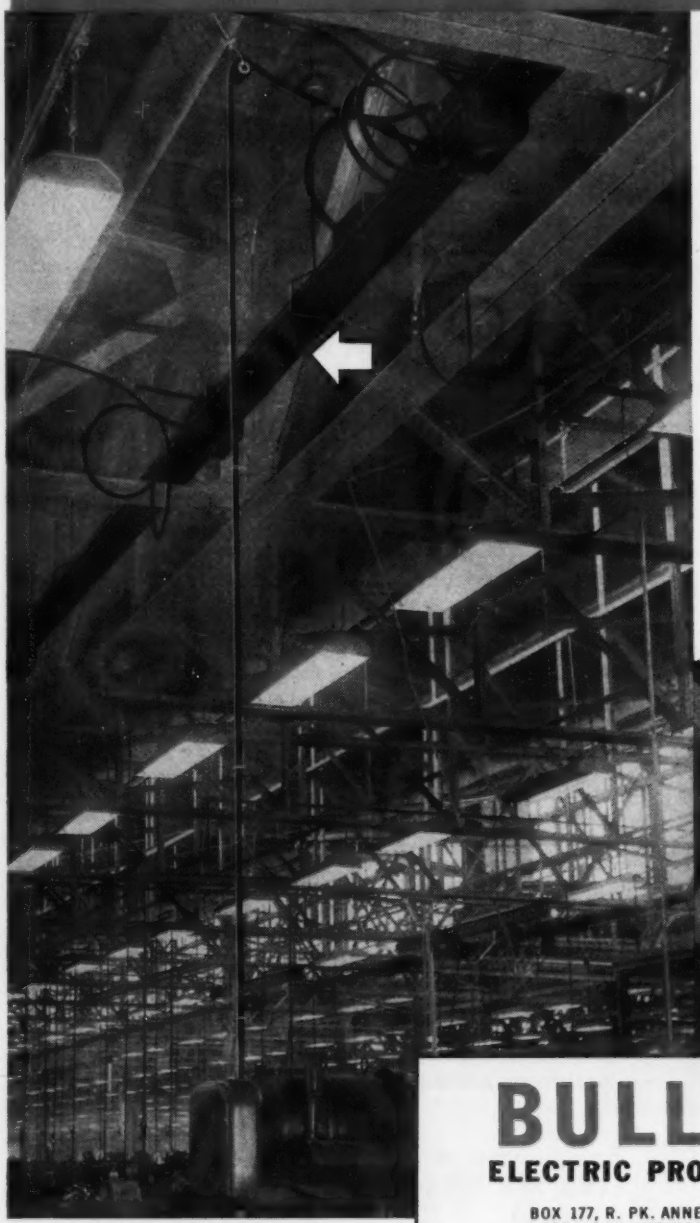
Preview

War-stimulated industrial development has given the Far West a new economic horizon that has a rosy tinge for the electrical industry. Low electrical rates, an abundant supply of power and a superabundance of undeveloped natural resources have provided a solid foundation for the war-developed industries and give assurance to the promise of a bright postwar industrial future for this region.

In the October issue the editors will analyze some of the future industrial possibilities of this region, particularly as they apply to the electrical industry. Iron and steel, light metals, chemicals and aircraft will have the spotlight turned on them. Feature articles will include an extensive discussion of the electrical aspects of the West's largest steel plant at Geneva, another on the first completely electrified oil refinery in this region and several others pointing up significant industrial electrical trends.



... BACK TO PEACETIME PRODUCTS



BULLDOG WILL SPEED RECONVERSION

In the great war conversion race, BullDog Electrical Distribution Systems have cut weeks — even months — from change-over schedules. Maintenance time and cost were slashed. Output was stepped up, safety improved.

The reason? BullDog Bus Duct systems make plug-in power for machines immediately available for any shop set-up—furnish mobile power for portable tools, cranes and hoists — provide completely flexible lighting.

Looking ahead, BullDog-equipped plants can also count on speedier, easier reconversion to peace production.

Now is the time to plan for the *reconversion* race. We offer the help of expert BullDog engineers, and will gladly send complete literature.

There's a Big Job Ahead — Buy More War Bonds

BullDog BUStribution DUCT provides complete flexibility on branch power circuits. The plug-in feature enables you to change production machines at will — rearrange whole departments without interrupting production elsewhere.

ALSO MANUFACTURERS OF
VACU-BREAK SAFETY SWITCHES • SWITCHBOARDS • SAFTOFUSE PANEL BOARDS • CIRCUIT MASTER BREAKERS • UNIVERSAL TROL-E-DUCT • INDUSTRIAL TROL-E-DUCT.

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1445 Stevenson St.
San Francisco, Calif., Tel. Hemlock 2470

Mullenbach Electrical Manufacturing Co.
2300 East 27th Street
Los Angeles, Calif., Tel. Jefferson 2224

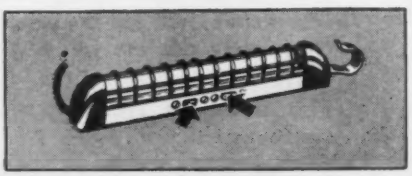
Fluorescent operating hints

No. 6 of a series by SYLVANIA for all users of fluorescent lighting

WHICH STARTER TO USE

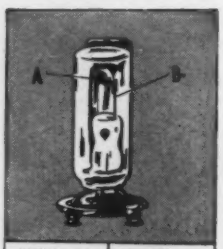
To light a fluorescent lamp, the two cathodes should be preheated for a short interval. The circuit must then be broken to establish the lighting arc. The fluorescent starter performs this function, acting as a time-delay switch. One starter is required for each lamp in a fixture. (Research has eliminated the starter from the fluorescent circuit in the laboratory, but starterless fluorescent equipment is not yet commercially available in quantities.) Following are the types of starters in most common use today:

MANUAL STARTER



Manual starters are the simplest type and are used principally on desk lamps or other portable fixtures. For example, in the Sylvania P-7 Fluorescent Extension Cord Lamp shown above, one switch turns on the current, and a second is pressed until the ends of the lamp glow to indicate adequate preheating. Then, the second switch is opened so that the lamp can strike its lighting arc. Manual starting is impractical for large installations or inaccessible fixtures, for which the following types of automatic starters have been developed.

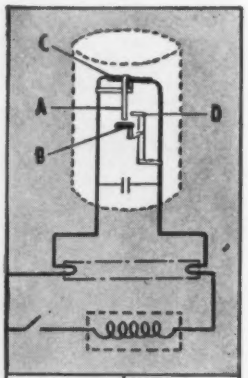
GLOW TYPE



With Lamps of this Wattage	Use Sylvania Glostat Model
30-40	FS-4
15-20	FS-2
4-6-8	FS-5

Glass bulb of starter is filled with low-pressure Argon gas. Current makes gas glow, and the resultant heat causes bimetal strip *A* to move over to make contact with *B*, thus preheating the lamp cathodes. This extinguishes the glow in the starter, thus cooling *A* and causing contacts to open. Current then establishes the lighting arc through the fluorescent lamp. Sylvania glow-type starters are manufactured under the name of Glostat, a quick-acting, rugged starter recommended for small and medium-sized fluorescent installations.

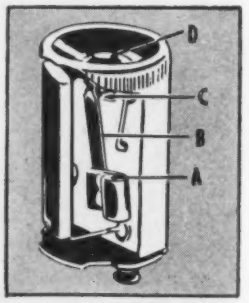
THERMAL TYPE



With Lamps of this Wattage	Use Sylvania Mirastat Model
15-20	M2
30-40	M4
65	M7
100	M6

In a thermal or resistance-heat-operated starter, when the line switch is closed, the bimetal operating strip *A* is touching carbon contact *B*, thus allowing the current to preheat the lamp cathodes. However, the heat generated by the current at this point of contact causes the bimetal *A* to move away from *B*, thus causing the current to strike the lighting arc. *A* is kept away from *B* by heat generated in resistor *C*, which is subjected to the same voltage as the lamp. In restarting, after a momentary interruption of current, *C* is subjected to full-line voltage, and the additional heat causes *A* to bend until it touches restart contact *D*. This allows current to preheat the cathodes again; but, at the same time, it short-circuits *C*, so that *A* moves away from *D*, causing the current to strike a lighting arc again. The Sylvania thermal-type starter is the Mirastat.

CUT-OUT (PUSHBUTTON) TYPE



When a lamp fails, automatic starters continue to make an effort to light the lamp. This causes blinking, wastes current, and injures the starter and ballast. Where immediate lamp replacement is impractical, use a starter with a mechanism that cuts the failed lamp out of circuit automatically. Cut-out starters are the thermal type with circuit breaker consisting of a small resistor *A*, a bimetal latch *B* as one contact, and a phosphor bronze spring *C* as the other contact. The current passes through these elements, which are held in contact position by the latch. When a lamp fails, heat is generated in *A*, which releases *C* and cuts the lamp out of the circuit. With a new lamp in place, the circuit breaker can be reset by pushing button *D*. Pushbutton starters last five to ten times longer than automatic starters, and they eliminate blinking. They are recommended particularly for large installations where the investment in fixtures and lamps is considerable. The Sylvania pushbutton starter is the COP (Cut-Out-Premium), available in model COP-4 for 40-watt lamps.

For additional maintenance information, **SEND FOR THIS FREE BOOKLET** ➡

One Standard — The Highest Anywhere Known

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FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

THE FIRST STANDARD LINE OF POWER BREAKERS

WITH 5 CYCLE OPENING SPEED

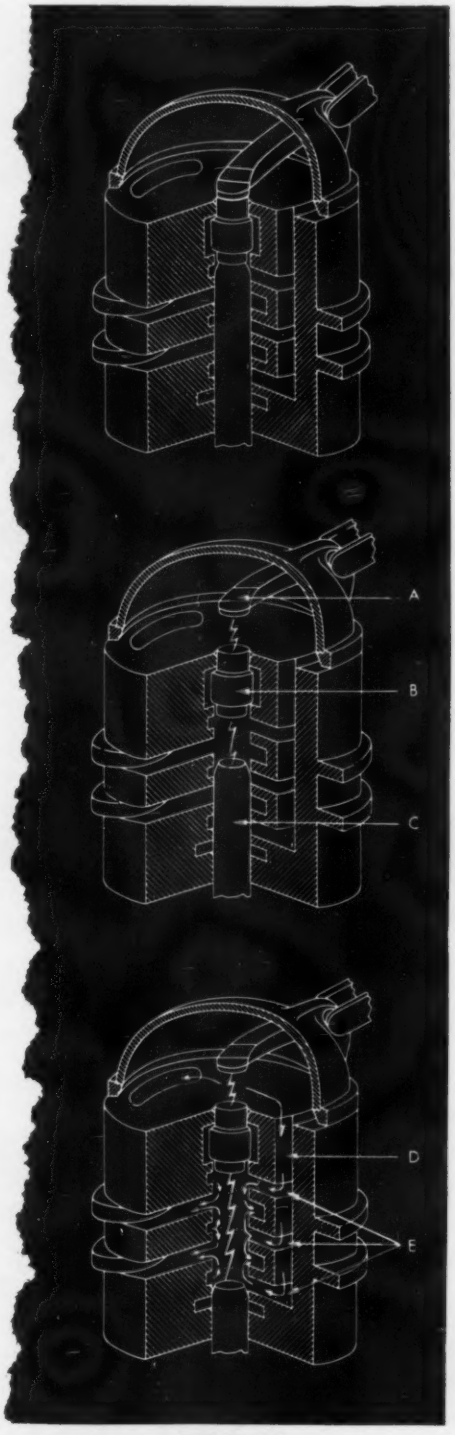
...thanks to this Multiflow "De-ion" action!

Westinghouse Type GM breakers provide —for the first time—a standard line of oil circuit breakers with 5-cycle opening time.

The secret of this faster opening speed is the new multiflow principle in the "De-ion" grids which extinguishes the arc faster by an oil flow which sweeps the arc products out of the vents. This produces an extremely high rate of deionization of the arc space at current zero (see panel at right).

Rated from 115 to 230 kv, these new Type GM breakers are actually smaller in size than the 8-cycle type they supersede, and require less oil and oil handling. Foundation size is reduced . . . maintenance is simplified by easier access to the grids and contacts. System stability is stepped up.

Most important, these new advantages have been made possible with no sacrifice in safety factor. Get complete information from your nearest Westinghouse office. Or write for D.D. 33-805. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.



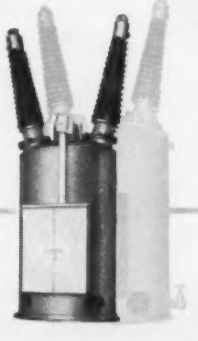
HOW "MULTIFLOW" WORKS

Contacts are closed. Equipment on the circuit operating normally and current is flowing through the breaker. But when some disturbance causes severe overload or short circuit, breaker trip coil is energized and contacts start to open . . .

As breaker opens, Contacts **A** and **B** separate, drawing an arc in the upper chamber, generating gas and creating pressure on the oil. Almost simultaneously, Contact **C** separates from Contact **B**, drawing an arc in the central orifice of the "De-ion" grid.

Oil pressure developed by the arc in the upper chamber forces oil through channels **D** into passages **E**. Oil flow (indicated by arrows) centers arc in the orifices, sweeps arc products out of the vents, and produces an extremely high rate of deionization of the arc space at current zero . . .

The dielectric strength of the gap at current zero has now been raised to the point where the arc cannot restrike, and the circuit is opened. The complete interruption takes place well within 50% of the grid, maintaining a large safety factor during normal operation. J-60564



Comparative size of the new GM breaker (left) and the old 8-cycle model is shown at right.

Westinghouse

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TYPE GM

Circuit Breakers

WESTINGHOUSE PRESENTS—*JOHN CHARLES THOMAS SUN. 2:30 E. W. T., N. B. C.—"TOP OF THE EVENING"— MON. WED. FRI. 10:15 E. W. T. BLUE NETWORK*

THE NEW KELVINATOR
Kelvinator

HOME FREEZER!

An important new home appliance for building postwar domestic load

To those electric utilities faced with the task of building up their domestic load in the postwar years, the new Kelvinator Home Freezer is good news.

There are three important reasons why the new Kelvinator Home Freezer can be depended upon to produce retail sales in volume and increase domestic load:

FIRST—a Home Freezer built by a company with more than 30 years of experience in the precision building of low temperature refrigeration units.

Kelvinator is the oldest manufacturer of cabinets designed specifically for the storage of ice cream and food products at low temperatures.

SECOND—a Home Freezer whose refrigeration power unit — the famed Kelvinator Polarsphere — has a proven record of trouble-free operation unmatched by any in the industry.

It is a record established in ice cream cabinets, beverage coolers, household refrigeration and commercial refrigerating units . . . first requisites of which are day-in, day-out uninterrupted performance.

THIRD—a name which has been synonymous with finest of dependable refrigeration in American homes for three decades.

It is a name which will produce immediate public acceptance for this great new Kelvinator product.

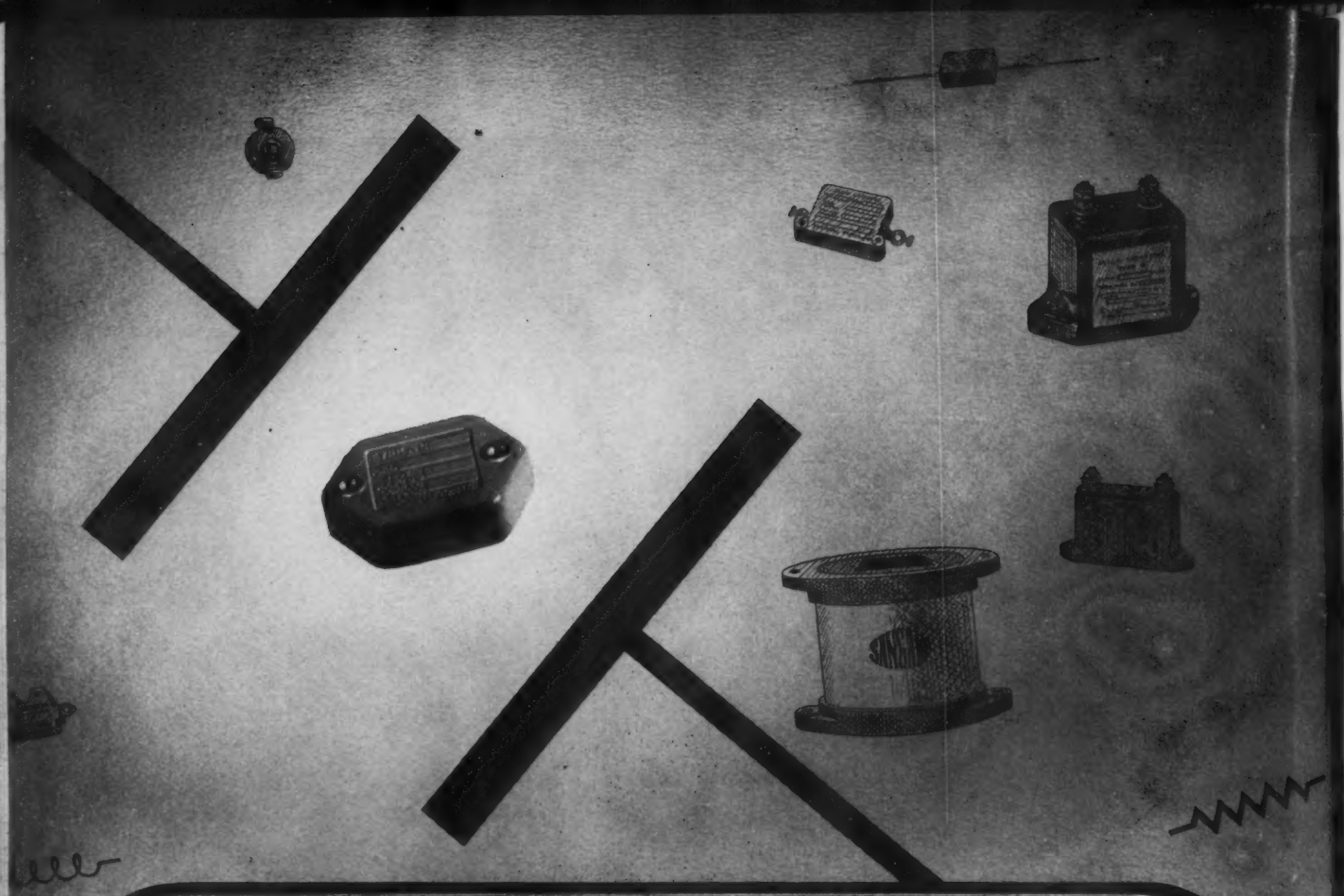
Plans for getting the new Kelvinator Home Freezers into homes and on utility power lines as quickly as possible after the war are well developed. They are a part of Kelvinator's long-range merchandising plan to get Kelvinator Refrigerators, Electric Ranges, Home Freezers and Electric Water Heaters into use where they will do their part in helping utilities increase their domestic load.

LOOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing

Awarded to Nash-Kelvinator Corporation, Propeller Division



Sangamo Capacitors Can Take It!

Sangamo Type A capacitors have been manufactured continuously since 1925. As the first mica capacitor to be moulded in bakelite, it has been incorporated into the designs of many transmitters and receivers. Designated under the War Standard as Case Styles CM55 and 60, this unit is available in all characteristics from B through F and in the entire range of voltages and capacities listed in these standards. While comparatively small in physical size, the "Type A" has been called upon to do an exceedingly big job in low-powered, medium, and quite often in high-powered transmitters, where the ability of a capacitor to stand up and handle comparatively large amounts of RF current is of paramount importance. The continued application of the Type A capacitor in these transmitters is adequate proof of its ability to meet these requirements. Manufactured under War Standard specifications calling for severe immersion tests, extreme temperature ranges, definite retrace or drift characteristics, this capacitor is an outstanding example of the advanced enginering design and manufacture inherent in the entire line of Sangamo Mica Capacitors.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

the little man who's always there

A roll of Security Friction Tape in the tool box or on the work bench is just as good as having a "Johnny-fix-it" around to splice electric wire and make emergency repairs. "Security" is always ready to "take hold" on construction or assembly jobs involving electrical connections, or to turn to wherever there's an emergency need.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

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"HE SAID THE LEO J. MEYBERG CO. COULD FIX HIM UP WITH ANYTHING, BUT THAT'S GOING TOO FAR!"

These indignant seamen can lower their blood pressure. Fixing up Robert the Robot with a high voltage date *is* out of our line. We stay safely with electric and electronic merchandise.

And we've got a broad range of stock right on our shelves. If we haven't got an item you need—we know where to get it—in a hurry. Over three hundred electric and electronic manufacturers are on our books, furnishing supplies that literally cover the electromagnetic spectrum . . . everything from a floor plug to an oscilloscope.

We can also rig a complete industrial broadcast and paging system; furnish you with an expertly engineered Near Infra-Red heating installation; illuminate your premises with incandescent or fluorescent lighting.

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BOOKS

you may want

MODERN OPERATIONAL MATHEMATICS IN ENGINEERING, by Ruel V. Churchill, 306 pages, 5x8, McGraw-Hill Book Co., $3.50.

The methods of operational calculus were first introduced by Oliver Heaviside in his work on electric circuit problems. Present-day engineering mathematicians, while achieving the same results, have based their methods upon more rigorous development based upon the Laplace transformation.

This book is an introduction to the modern operational mathematics. A few simple operational methods are familiar to all engineers. Integration and differentiation are examples. In either of these processes starting with a given function an operation is performed upon it according to definite rules and yielding a resultant function. In the case of the Laplace transformation, the operation includes both multiplication by an exponential function and integration from zero to infinity.

In this book methods for applying the Laplace transformation to a variety of functions are developed. The value of these methods is illustrated by applications to problems of mechanical vibration and resonance. Further developments are applicable to problems in heat conduction and electrical transients. Because of the close relationship to use of the Laplace transformation, a chapter is included on functions of a complex variable. An appendix contains an extensive table of Laplace transforms.

Although introductory in nature and intended for the junior or senior year engineering student, this book is not for the casual reader. It is a valuable textbook or a reference work for the engineer who is seriously interested in modern operational mathematics.—W.R.J.

WORK METHODS MANUAL, by Ralph M. Barnes, 136 pages, 6 x 9, index, illustrated, John Wiley & Sons, $1.75.

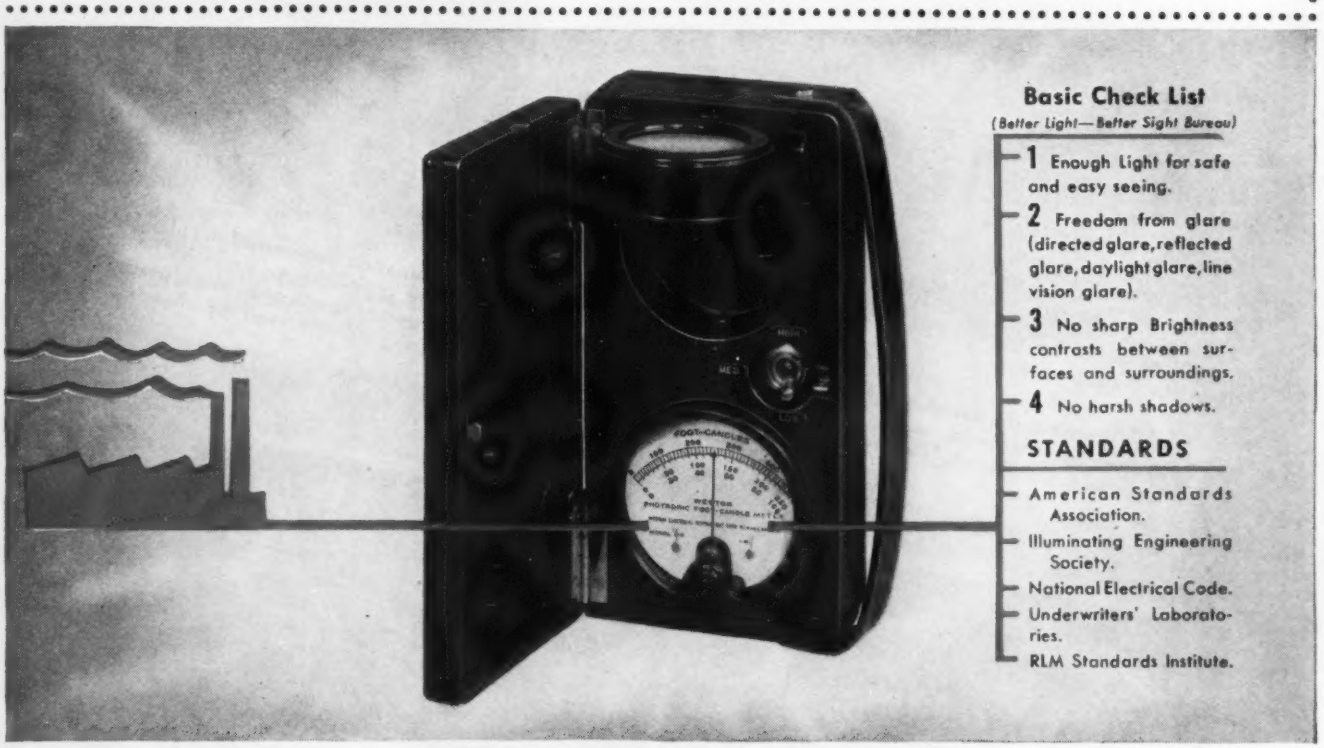
A guide for supervisors, foremen and workers on the principles of work organization and motion economy and how to do the job with greater economy and efficiency, with less effort. The book contains the same principles and techniques used in training professional industrial engineers. Although the subject of stop-watch time study and rate setting has been omitted, the book contains a full discussion of process charts, man and machine parts, and operation analysis. Ten principles of motion economy which have widest application have been included, with specific illustrations of application and results that may be expected. —W. C. H.

TWENTIETH CENTURY ENGINEERING, by C. H. S. Tupholme, 201 pages, 6x9, index, illustrated, Philosophical Library, New York, $3.

This book is the result of the author's desire to place in the hands of laymen primarily, an informative and readable discussion of some of the more spectacular engineering progress of the past few years, both during and immediately before the war. Progress has been so rapid and covers so many branches of engineering science that no attempt has been made to go into exhaustive detail in any particular field. The text may well be found of interest to

(Continued on Page 14)

How far is your Lighting from Today's accepted Industry Standards?


Basic Check List
(Better Light—Better Sight Bureau)
1 Enough Light for safe and easy seeing.
2 Freedom from glare (directed glare, reflected glare, daylight glare, line vision glare).
3 No sharp Brightness contrasts between surfaces and surroundings.
4 No harsh shadows.
STANDARDS
American Standards Association.
Illuminating Engineering Society.
National Electrical Code.
Underwriters' Laboratories.
RLM Standards Institute.

TODAY'S accepted lighting standards in Industry are being proven by war production as essential to higher rates and quality of production . . . to employes' maximum safety, health, and morale.

Does your lighting meet these higher Industry lighting standards? Only a job by job and department by department survey of your plant will enable you to determine your answer. Unless your plant has been newly built or has been completely re-lighted within the past three years, you will probably find that for many seeing tasks and in many departments, your employes have insufficient or improper lighting during most of the day and all of the night.

Lighting Deserves Executive Attention

Executive consideration of the lighting question is indicated by the fact that adequate lighting and comfortable seeing in conformance with the American Recommended Practice of Industrial Lighting is a part of the problem of "general working conditions."

Importance of Fixture Design

To provide efficiently and economically lighting that conforms to today's Accepted Industry Standards requires careful selection of properly designed equipment. To be properly designed, equipment must provide proper shielding of the light source to minimize direct glare, provide the proper direction, distribution and diffusion of the light upon horizontal and vertical surfaces and for certain special locations protection against hazards of explosive gases dust and water vapors.

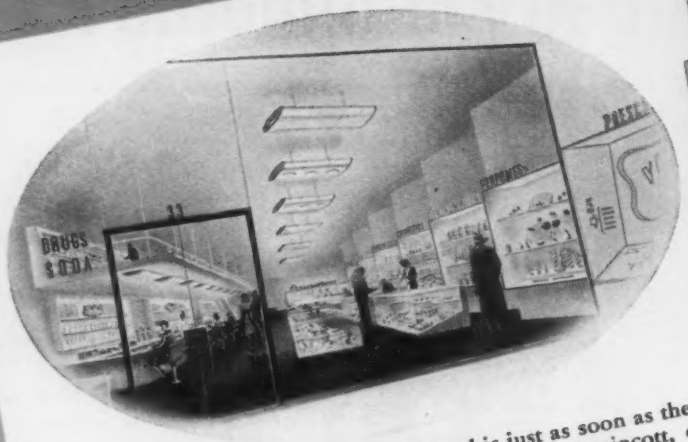
Through the specification of Benjamin equipment assurance is had of equipment design and construction which conforms with all recognized illumination, electrical and mechanical standards as provided by the National Electrical Code and the RLM Standards Institute.

Write for FREE Booklet

Send for a Free copy of the Booklet "Productive Lighting" containing much valuable information on how to obtain best lighting results. With it will be sent complete information on how you may obtain the assistance of a Benjamin Trained Lighting Specialist in analyzing the performance of your lighting and in making recommendations without cost or obligation. BENJAMIN ELECTRIC MFG. Co., Dept. J, Des Plaines, Illinois.

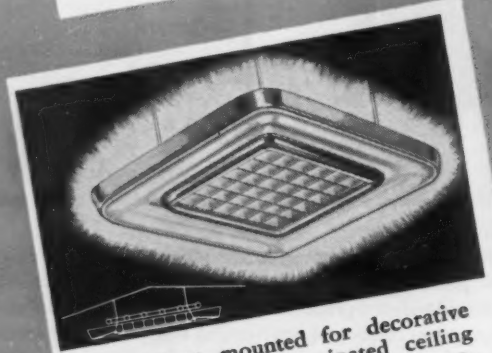
BENJAMIN TRADE MARK
Lighting Equipment
Distributed Exclusively Through Electrical Wholesalers

From G-E's Design Program—IDEAS OF



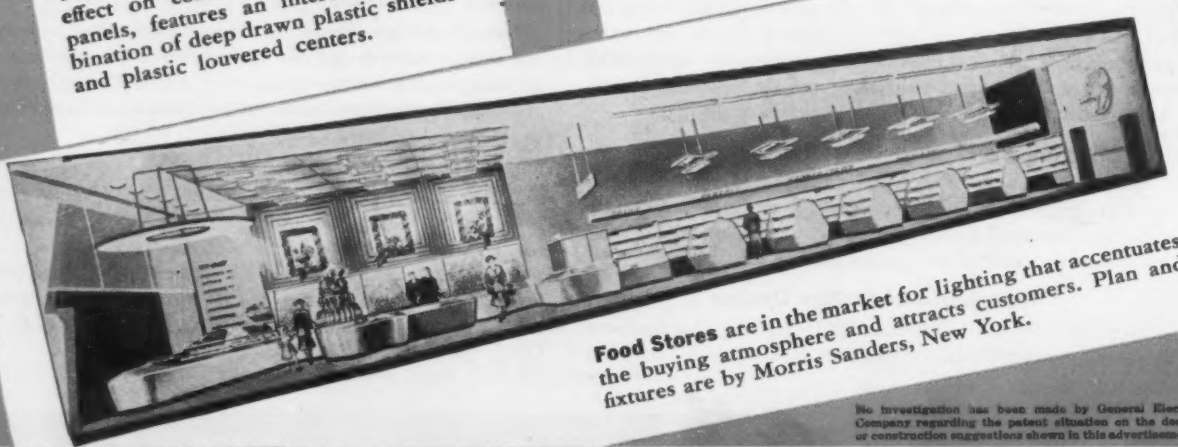
Drug stores want modern lighting like this just as soon as they can get it. Plan and fixture are by J. Gordon Lippincott, of Dohner & Lippincott, New York.

Combination fluorescent and filament lighting fixture shown above employs four 48-inch fluorescent lamps plus concentrated down-lighting on displayed merchandise.



This fixture, mounted for decorative effect on coffered laminated ceiling panels, features an interesting combination of deep drawn plastic shields and plastic louvered centers.

This luminaire combines light for general ceiling illumination and concentrated light that highlights display surfaces. The canopy is low-pressure molded plastic; lower part is translucent plastic.



Food Stores are in the market for lighting that accentuates the buying atmosphere and attracts customers. Plan and fixtures are by Morris Sanders, New York.

No investigation has been made by General Electric Company regarding the patent situation on the design or construction suggestions shown in this advertisement.

GENERAL ELECTRIC

Hear the General Electric radio programs: "The G-E All-Girl Orchestra", Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

LEADING DESIGNERS ON POSTWAR FIXTURES

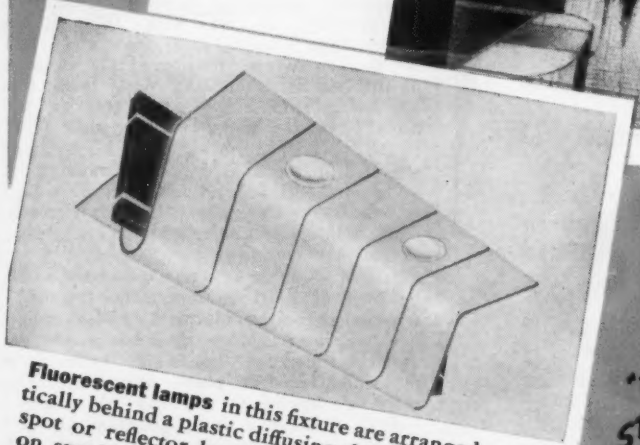
TODAY, almost 1,500,000 stores in this country need relighting. To help you bring them the full benefits of modern lighting, General Electric is commissioning leading architects and designers to work out ideas for new and more attractive lighting fixtures. Seventeen of these men are now at work on this program. Several of their ideas are illustrated here. More of them will be ready soon.

From these original designs, fixture manufacturers are already working on new lighting tools that will help you get a full share of postwar lighting profits.

ILLUSTRATED BOOKLET *describing G-E's design program is now available. Write for Booklet Y-467, General Electric, Nela Park, Cleveland 12, Ohio.*

Shallow, ceiling-mounted fixture with translucent plastic sides and "egg-crate" plastic louvers for light diffusion. Two spotlight housings in center are adjustable for directional lighting.

Department and Specialty stores know that good lighting sells merchandise. Thousands already have complete modernization programs. Plan and fixtures shown here are by Graham, Anderson, Probst & White, Chicago.



Fluorescent lamps in this fixture are arranged vertically behind a plastic diffusing shield. Adjustable spot or reflector lamps may be readily directed on special merchandise displays.

"TO MAKE G-E LAMPS STAY BRIGHTER LONGER"
The Constant Aim of G-E LAMP RESEARCH

G-E MAZDA LAMPS

KEEP BUYING WAR BONDS — KEEP THE WAR BONDS YOU BUY

many engineers and engineering students who are now in the armed forces and who desire to bring themselves up to date on latest developments. Chapters cover: mechanical power; engineering workshop processes; air conditioning and refrigeration; chemical and metallurgical engineering; electrical engineering; traction; marine engineering; aircraft, and physics.—W. C. H.

LETTERS
to the editor

To the Editor:

After reading the July issue of the ELECTRICAL WEST, I feel compelled to write you again in regard to Mr. Burnett's article on *Phase Relations of Transformer Banks.*

His corrected article is only slightly changed from the original. He interchanged (XI) and (X2) at two points in the text and H's and X's were added to the diagrams. That is all. The conclusion as to degrees of phase shift produced by the different bank connections, is still in error. These conclusions result from two fundamental errors. First, the A, B, C phase markings are not applied to the bank secondaries with proper consideration to polarity. Second, the vectors as drawn for each connection do not show the proper regard for polarity.

It is difficult, without the use of diagrams, to explain the proper application of phase markings and voltage vectors to a given transformer bank. We will, however, suggest four rules which, if consistently applied, will give one a true picture of the phase relations of transformer banks.

1. Accepted engineering practice calls for a counter-clockwise rotation of vectors. That is, a vector that is drawn (N) degrees in a counter-clockwise direction from a vector (X) is considered as leading (X) by (N) degrees.

2. Single-phase transformer terminals are designated (according to accepted engineering practice) as (H1) and (H2) for the high-voltage winding and (X1) and (X2) for the low-voltage winding. (H1) is taken as the left hand terminal, when facing the low-voltage side. (X1) is the "polarity" terminal of the low-voltage winding while (H1) is the "polarity" terminal of the high-voltage winding. In an additive polarity transformer, (X1) is the right-hand terminal, when facing the low-voltage side. (X1) is the left-hand terminal of a subtractive polarity transformer.

3. If (A) phase is connected to the (H1) terminal of a transformer, then the (X1) terminal is the secondary (A) phase connection. Or if (A) phase should be connected to (H2) terminal then (X2) terminal is the secondary (A) phase connection. The same rule applies to (B) and (C) phases.

4. In drawing a vector diagram to show the voltage relation between the high- and low-voltage sides of a transformer bank, the fundamental rule is: The vector representing the voltage impressed on any load connected from (X1) to (X2) terminals is drawn parallel to and in the same direction as the vector representing the voltage applied to the high-voltage winding from terminal (H1) to (H2).

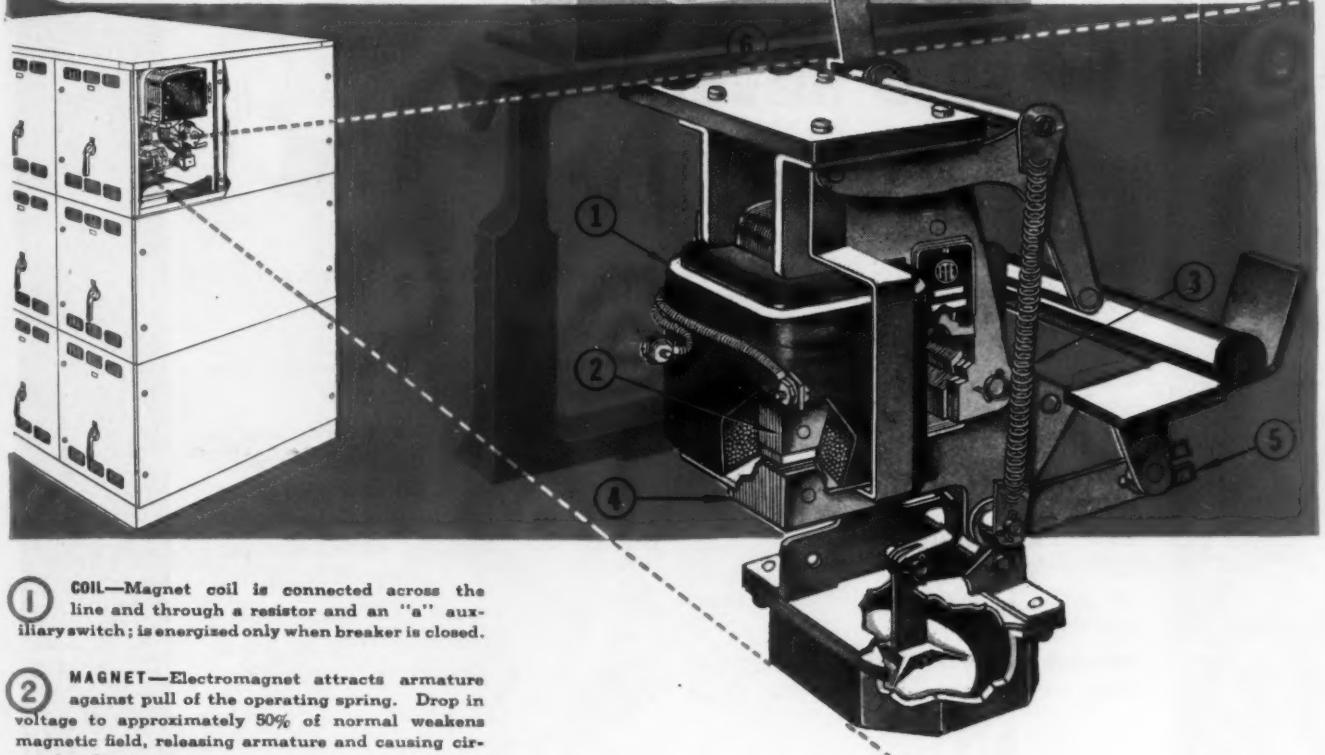
In other words, on every single-phase transformer, the terminal voltage (X1) to (X2) is "in phase" with terminal voltage (H1) to (H2).

F. V. Gillum.

Pomona, Calif.

Features of I-T-E DRAWOUT SWITCHGEAR

This UNDERVOLTAGE TRIP protects motors and driven equipment from damage caused by POWER FAILURE



1 COIL—Magnet coil is connected across the line and through a resistor and an "a" auxiliary switch; is energized only when breaker is closed.

2 MAGNET—Electromagnet attracts armature against pull of the operating spring. Drop in voltage to approximately 50% of normal weakens magnetic field, releasing armature and causing circuit breaker to open.

3 OPERATING SPRING—When circuit breaker is open, spring holds armature against faces of magnet poles. When circuit breaker is closed a change in position of the linkage makes spring tend to pull armature away. Magnet resists this action.

4 ARMATURE—Attracted by magnet against the pull of the operating spring when circuit breaker is closed. Release of armature opens breaker through link to tripper bar.

5 LINK TO TRIPPER BAR—Transmits movement of armature to trip mechanism that opens breaker when pull of operating spring overcomes attraction of magnet because of undervoltage condition.

6 SPRING ARM LINK—Attached to circuit breaker mechanism at upper end. Releases linkage so that operating spring holds armature against pole faces of magnet when breaker is open. When breaker is closed, it sets arm so that spring tends to pull armature away from pole faces.

Hazards arising from power failure are well known to operating men. The unexpected slowing or stopping of motor drives followed by equally unforeseen resumption of full speed can give rise to conditions damaging for d-c armatures and a-c windings, can do harm to machining and processing equipment, can injure workmen.

Protection against "undervoltage" is simple in principle. A drop to a predetermined, critical value causes a magnet to release an armature and the breaker opens. From that point, there need be no damaging current or unforeseen resumption of power or load.

Simple as this is, what you want on the part of the undervoltage trip is positive, dependable action. This I-T-E gives you—and we will gladly tell you about it to the last detail. Just call the nearest I-T-E representative or write to I-T-E Circuit Breaker Co., 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

FOR LASTING, DEPENDABLE SERVICE...

rely on these 6 advantages of Transite Ducts

Inorganic . . . made of an asbestos and cement composition compressed under great pressure. This provides permanence and strength. These ducts are also immune to rust and rot.

Permanently smooth bore . . . long cable pulls and replacements are made easier. Danger of damage to cables is minimized.

Easily and quickly installed . . . long, light-weight lengths and simple assembly method assure rapid, economical installation.

Immune to electrolysis . . . being entirely inorganic and non-metallic, these ducts are not affected by electrolysis or galvanic action.

Lower cable temperatures . . . an advantage resulting from a relatively high rate of heat dissipation.

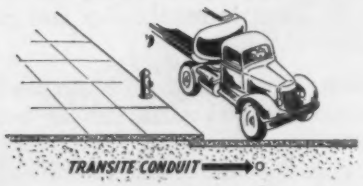
Incombustible . . . won't contribute to the formation of dangerous smoke, gases, or fumes. If burnouts do occur, these inorganic ducts provide maximum protection to adjacent cables and permit easy removal of damaged conductor.

For complete details on Transite Ducts, write for Data Book, DS-410, Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JOHNS-MANVILLE PRODUCTS

JOHNS-MANVILLE *TRANSITE DUCTS*

TRANSITE *CONDUIT*



Designed for exposed work and for use underground without a concrete encasement.

TRANSITE *KORDUCT*

For use in concrete. Thinner walled, otherwise identical with Transite Conduit.

SOON EVERYONE WILL "go" MULTI-BREAKER"

..and the time for **YOU** *to start is right* **NOW!**

You are a Wholesaler

. . . then be sure that your salesmen are telling the Trumbull Multi-Breaker story to contractors . . . pointing out the opportunities that will come with post-war building . . . not forgetting the many equally good opportunities that exist TODAY in replacement and essential installations.

You are a Contractor

. . . then sell Trumbull Multi-Breaker automatic overload and short circuit protection, *with nothing to renew or replace.* Architects' plans are being drawn for post-war building . . . with Multi-Breaker applications. Modernization and essential installations are ready for Multi-Breakers right now. Multi-Breaker advantages in safety and convenience *cost no more.*

You are an Architect

. . . then be sure you have full information concerning this *safe and better way* to protect lighting and appliance circuits. No replacements — no servicing required. Service restored at the "flip of a switch". Specify them — they will improve electrical efficiency in the buildings you design.

You are a Builder

. . . then consider Trumbull Multi-Breakers as one of the sales features of your future construction . . . especially since they do not add to the cost of the electrical installation.

Write for your copy of Trumbullaid Circular No. 323.

You are a Building Owner

. . . then consider the savings in maintenance and service with Trumbull Multi-Breakers. No more emergency calls to replace fuses, no danger of replacing fuses with others of wrong capacity. With NOTHING to renew or replace-even a child can restore service.

ELECTRICAL CONTROL APPARATUS

Enclosed Switches & Circuit Breakers
Motor Control

TRUMBULL (T)
MULTI-BREAKER LOAD CENTERS

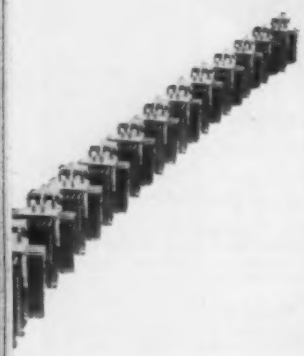
Control Centers
Panelboards Switchboards
Busways Distribution Systems
Service Equipment

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC (GE) ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

THE NEW, QUICK WAY TO BUY

G-E Power Transformers AT LESS COST



Q. What are "RM listed" transformers?

A. They are General Electric's repetitive-manufacture* power transformers, made according to standard designs, using many parts which we can make in large quantities and carry in stock.

Q. What are the chief advantages of repetitive-manufacture transformers, as compared with special custom-built units?

A. Quicker delivery (33% less time), lower prices, simplified purchasing, and a better product. Outline drawings are available *immediately,* and work on foundations and station structure can be started at once.

Q. Why do RM-listed transformers make such short shipping schedules possible?

A. Because detailed engineering and drafting on individual designs are unnecessary, and because manufacturing time is reduced by the use of many stock parts.

Q. If RM-listed transformers cost less, is there any sacrifice in quality?

A. No, here's why. Repetitive-manufacture transformers embody the same refinements of design, high-quality materials, and precise workmanship which have made G-E power transformers outstanding. The lower price is made possible through the reduced engineering and drafting requirements, and by the economies obtained through quantity production of parts.

Q. How does a repetitive-manufacture transformer simplify purchasing?

A. Each RM-listed transformer is an established product with known characteristics that meet industry standards. No detailed specifications are required—you simply specify rating and optional accessories desired.

Q. Why are RM-listed transformers "better?"

A. Designs, manufacturing methods, and materials can be studied and improved more rapidly on a standardized line. *Repetition leads to perfection.*

Q. Are designs "frozen" to permit repetitive manufacture?

A. No, not in the strict sense of the word—all new developments and design improvements will be incorporated.

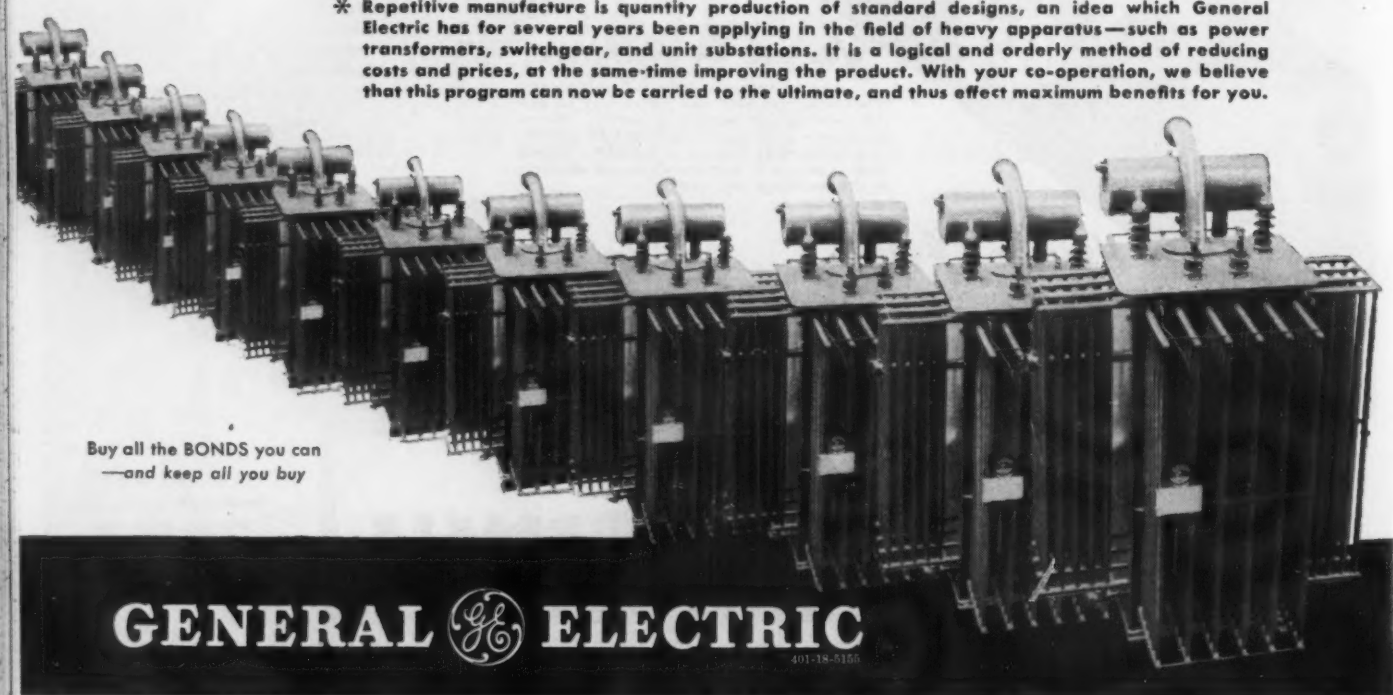
Q. Do RM-listed transformers offer any other advantages?

A. Yes. Standardization means a reduction in the number of spare units that you need to carry.

Q. What terminal arrangements are available?

A. Cover bushings, or junction boxes and switches with potheads, can be supplied. Many other optional features can be added, as shown in our bulletin, No. GEA-4283. A complete line of repetitive-manufacture unit substations is also available.

*** Repetitive manufacture is quantity production of standard designs, an idea which General Electric has for several years been applying in the field of heavy apparatus—such as power transformers, switchgear, and unit substations. It is a logical and orderly method of reducing costs and prices, at the same-time improving the product. With your co-operation, we believe that this program can now be carried to the ultimate, and thus effect maximum benefits for you.**



Buy all the BONDS you can
—and keep all you buy

GENERAL ELECTRIC

401-18-5155

SPECIFY RM LISTINGS

SINGLE PHASE 60 CYCLES		Self-cooled Kva Ratings									
		667	833	1000	1250	1667	2000	2500	3333	4000	5000
		Self-cooled Forced-air-cooled Kva Ratings									
High-voltage Ratings	Low-voltage Ratings †	667/834	833/1041	1000/1250	1250/1562	1667/2084	2000/2500	2500/3125	3333/4444	4000/5333	5000/6667
2400/4160Y	480, 600										
4800/8320Y	480, 600, 2400/4160Y										
7200/12470Y 12000 △ 12470 △ 13200 △ 14400 △	480, 600										
	2400/4160Y, 2500/4330Y, 5000/8660Y, 7200/12470Y										
22000 △ 27600 △ 33000 △ 44000 △ 66000 △	2400/4160Y, 2500/4330Y, 5000/8660Y										
	12000, 7200/12470Y, 12470, 13800, 14400										

RM LISTINGS

THREE PHASE 60 CYCLES		Self-cooled Kva Ratings										
		750	1000	1500	2000	2500	3000	3750	5000	6000	7500	10,000
		Self-cooled Forced-air-cooled Kva Ratings										
High-voltage Ratings	Low-voltage Ratings †	750/938	1000/1250	1500/1875	2000/2500	2500/3125	3000/3916	3750/5000	5000/6667	6000/8000	7500/10,000	10,000/13,333
2400 △ 4160 △ or Y 4800 △ or Y	240, 208Y/120											
	480, 600, 480Y/277											
7200 △ or Y‡ 12000 △ or Y 12470 △ or Y 13200 △ or Y 14400 △ or Y	240, 208Y/120											
	480, 600, 480Y/277											
	2400, 2500, 4160Y, 4330Y, 5000, 7200, 8660Y											
22000 △ or Y 27600 △ or Y 33000 △ or Y	2400, 2500, 4160Y, 4330Y, 5000, 7200, 8660Y											
	12000Y, 12470Y, 13800Y, 14400Y											
44000 △ or Y 66000 △ or Y	2400, 2500, 4160Y, 4330Y, 5000, 7200, 8660Y											
	12000Y, 12470Y, 13800Y, 14400Y											

RM LISTINGS

†Y-Y connections are outside the scope of RM listings.
‡Has low-voltage ratings of 240, 120/208Y, 480, 600, 277/480Y, 2400, and 4800.

The standard kva and voltage ratings of General Electric RM-listed power transformers are shown in the tables above. There are 2684 standard ratings, so selected as to make them adaptable to most normal and many special applications. Oil-filled and Pyranol designs are available. All ratings, tolerances, and test guarantees are in accordance with ASA standards.

HIGH-VOLTAGE TAPS—Four $2\frac{1}{2}$ per cent rated kva taps provide a tap range of 5 per cent above and 5 per cent below rated high voltage.

SPECIALS—Naturally, every possible transformer rating cannot be included in our repetitive-manufacture line. Ratings not covered can, of course, still be obtained. Your co-operation in specifying more and more standard units will bring increased benefits to you.

For complete information ask for GEA-4283. *General Electric, Schenectady 5, N. Y.*

REPETITIVE MANUFACTURE . . . A New Field for Co-operation

HOLOPHANE presents

SUPERFICIENCY
*"One-point-five"
REFLECTORS

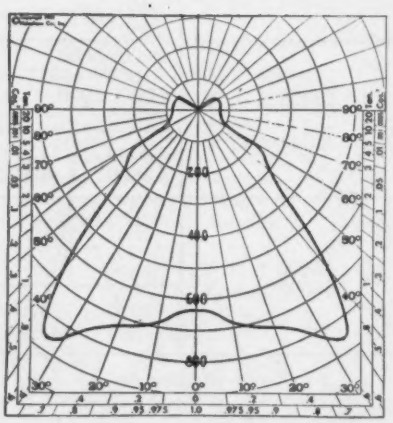
Conduit (½") Mounting Type

Outlet box cover Mounting Type

Prismatic Reflector

***Product of Holophane Research,* SUPERFICIENCY REFLECTORS** are the advanced answer to the growing need for modestly priced small glass units for general industrial and utility areas. These reflectors are altogether new in optical design. They express the traditional Holophane principles of high lighting efficiency, easy installation and maintenance. Their adaptability to standard size fitters and their wide range of wattage—25 to 300 watts—make them practical and economical for general service. Application, performance and price data available on request.

- *PRISMATIC GLASS for maintained efficiency*
- *PRACTICAL for replacements on existing jobs*
- *ECONOMICAL INSTALLATION and MAINTENANCE*



★ ***"One-point-five" Reflectors** are designed to provide efficient, even illumination on spacings as great as 1.5 TIMES the mounting height above working plane.*

HOLOPHANE COMPANY, INC..... *Lighting Authorities Since 1898*

342 MADISON AVENUE, NEW YORK 17 · Holophane Co., Ltd., 385 Yonge St., Toronto, Can.

Pacific Coast Representatives:—R. G. Dummel, San Francisco; F. van Gilluwe, Los Angeles

KYLE Oil Circuit Breakers

GIVE GREATER PROTECTION TO YOUR LINES OR SYSTEMS BY PROVIDING...

1 GREATER SAFETY to the Lineman

ONLY ONE HOT SPOT

Terminals at top of breaker bushings are only exposed live parts. This protects the lineman from hazard of accidental contact when inspecting or working near breaker.

NO SHOCK IMPARTED TO HANDLE

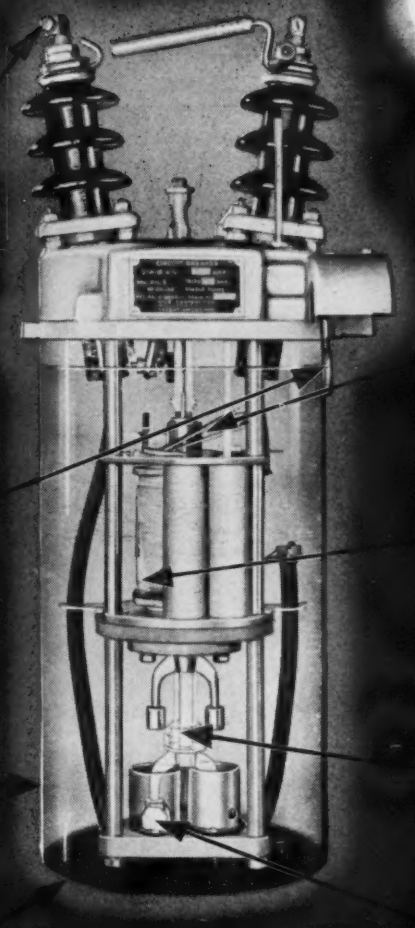
Handle used to operate the breaker is not directly connected with the operating mechanism and cannot impart a blow to operator. Normal position is the open, safe position.

TANK IS DEAD

The tank is dead and provisions are made for grounding it. The entire top is dead and the breaker may be installed or serviced with complete safety. Mechanism is insulated from tank.

NO BOTTOM TERMINAL

With the Kyle Circuit Breaker there is no chance of injury to a lineman because of a hot terminal at the bottom of the breaker. Kyle design allows pole mounting with perfect safety.



Ratings of Kyle Oil Circuit Breaker

2300 to 15,000 volts a.c.
Nominal Ratings: 3 to 50 amperes
Minimum Trip Currents: 8 to 12 amperes
Interrupting Capacities: 75 to 1200 amperes
Weight With Oil: 135 pounds

2 GREATER SAFETY to the Breaker

THERMAL "SAFETY VALVE"

Thermal trip acts as safety valve to protect breaker from burning up due to temporary overloads . . . causes breaker to lock out if temperature reaches approximately 200° F.

LARGE WIRE SIZE CUTS HEAT

To reduce heating to a minimum, the wire size in the Kyle breaker is large. This also reduces the IR drop through the breaker . . . reduces heat hazard from high resistance faults.

PLUNGER IS CUSHIONED

Plunger is hydraulically cushioned to withstand mechanical shock caused by lightning surges or direct faults to ground.

CONTACTS PREVENT BURNING

Special arcing tips, which ride on the outside of the upper, movable contacts, eliminate burning of the main current carrying surfaces. The load is always carried on clean contacts.

While protection of both life and property are cardinal features of the design of the Kyle Oil Circuit Breaker, it operates in such a way as to require a minimum of physical attention.

More than 85% of the faults on a line are of a temporary nature. These are generally cleared by the first opening of the breaker.

The positive, dependable, hydraulic timing of the Kyle breaker allows a fast opening of the breaker which is followed by a three-second closing interval. After the third opening, if the fault is still in existence, the breaker locks out on the fourth operation. The breaker then remains locked-out until reset manually.

The Kyle Oil Circuit Breaker is electrically and mechanically sound. It has a high interrupting capacity and will not fail in protecting the line. The construction assures long life, ease of operation and unusual resistance to wear and deterioration

KYLE Circuit Breakers are Designed and Manufactured for
LINE MATERIAL COMPANY, Milwaukee, Wisconsin

KYLE CORPORATION
SOUTH MILWAUKEE, WISCONSIN

Electrical Insulation

Mica's new "3 mil" bias cut cambric tape, for wound insulation where space-saving is an important factor. Inset shows oval insulating tube for interpole coils of submarine blower motor, made of Supermicanite

...DESIGNED FOR DESIGNERS

Elevated operating temperatures... greater speeds . . . higher frequencies...compactness of the new functional designs—all mark the trend in re-designing postwar products for civilian use. And all point clearly to the need for "made-to-measure" insulations, which combine the *surety* of time-tested materials with precision fabrication of intricate insulating parts.

Mica Insulator Company brings to this problem a single supply source of diversified materials and an undivided responsibility for their fabrication. With strategically located fabrication facilities and nation-wide distribution of LAMICOID plastic laminates—EMPIRE varnished cloths and tapes—MICA and MICANITE—we are equipped and conditioned by half a hundred years of insulation experience to offer a quick, dependable and complete source of highly specialized insulating materials and products.

Designers and manufacturers of electrical and electronic equipment of all kinds are invited to enlist this service—without obligation—in the solution of insulation problems—present or projected.

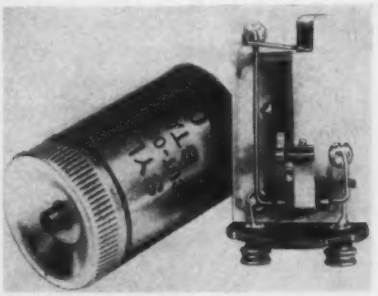
For prompt service consult our western representative:
THE TRIANGLE PACIFIC COMPANY
SAN FRANCISCO: 1045 Bryant Street • LOS ANGELES: 340 Azusa Street
SEATTLE: 95 Connecticut Street

MICA INSULATOR COMPANY
200 VARICK STREET, NEW YORK 14, N. Y.

PRODUCTS
that are news

Push Button Starter (900)

Sylvania Electric Products has a new push-button type fluorescent lamp starter, which it has labeled the COP (cut-out premium). According to the announcement, the starter will also automatically cut the circuit in case of lamp failure. It is stated that in tests, the new starter has shown a life expectancy five times as long as the average starter. It is made in one size, for 40-watt lamps.

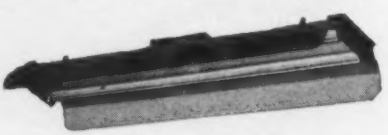


Inspection Lamps (901)

Reliance Devices Co. has added a line of portable inspection lamps, available with 9- or 12-in. arms and in brown or gray with a choice of three different types of shades. These lamps are mounted on a 2-lb. base. The socket is the company's regular Swivelier unit, is said to rotate 350° horizontally and to adjust 180° vertically, to require no wing nuts or set screws for adjustment. The base has three wood screw holes permitting the unit to be hung.

Industrial Luminaire (902)

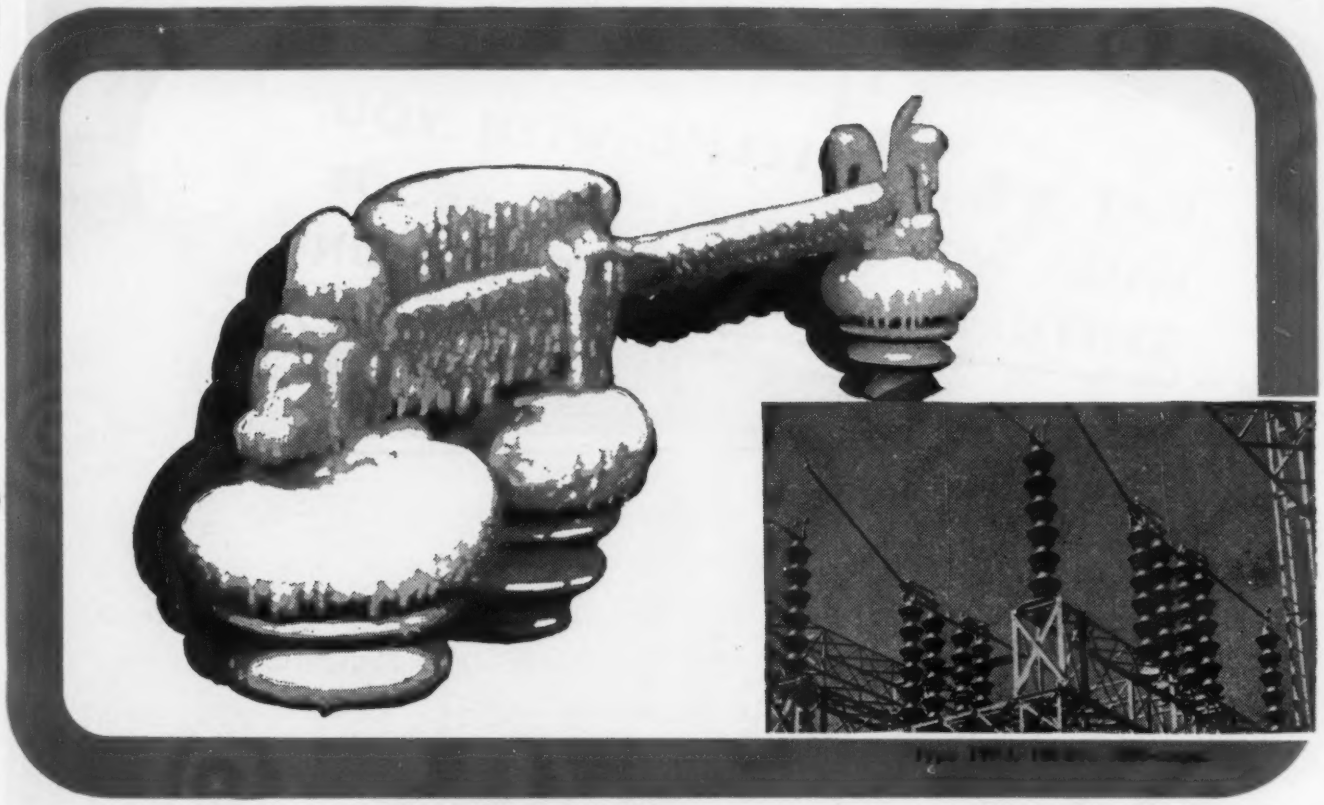
Bright Light Reflector Co. is offering a Silv-A-King fluorescent industrial unit in the low-priced range. This unit is all steel and, according to the announcement, meets RLM requirements for reflectivity, shielding angle, contour and efficiency. The hood is fitted with end-plates, which act as "bumpers" to



prevent sockets from breaking or being forced out of position. Knockouts, provided for bushings and locknuts when units are joined, can be used also for a pull switch. Provision is made for insertion of sockets and starters, permitting addition of a third lamp. Ballast is exposed.

Insulator Cleaner (903)

Nielco Laboratories has developed an alkali cleaner for porcelain insulators, which it claims is of low sodium oxide content, free flowing and readily soluble in tepid water. The manufacturer states that the cleaner gives off no harmful caustic vapors when used at boiling temperatures and is less harmful to the hands than ordinary strong alkali cleaners.



..when FROZEN STIFF_

OPERATION IS STILL EASY

This PACIFIC ELECTRIC Switch-Blade Rotates, Cracks Ice, Then Opens . . .

For simple and easy operation under ice conditions—operating men like this Pacific Electric Switch.

Just move the operating handle. That first *turns* the blade, splitting the ice at both the contact and hinge. Then the switch blade starts moving in its vertical arc—simple and easily without the use of gadgets.

If the switch is frozen in the open position, its chisel-like blade cuts into and knocks off the ice.

Here is summer reliability in switch operation when sleet pulls wires down.

For further assurance of easy operation in all seasons, the switch is counter-balanced. It has high-pressure contacts with silver inserts for cool operation while carrying full load.

Yes, it's made for utilities that want the most reliability for long years with the least upkeep, this switch designed by the Pacific Electric Mfg. Corporation, for 38 years specialists in producing high-voltage switching equipment.

Ask for full details about these switches which break through ice and operate easily because the blade rotates before moving in its vertical arc.

C. H. Cutter
1015 Securities Bldg.
Seattle, 1, Wash.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, 13, Calif.

Northwest Supply Co.
909 E. Second St.
Butte, Montana

J. E. Redmond Co.
448 W. Madison St.
Phoenix, Ariz.

Myron Swendsen
P. O. Box 156
Boise, Idaho

R. Ackerman
318 Dooly Block
Salt Lake City, 1, Utah

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO 24, CALIF. P. O. BOX 419, GARY, INDIANA

MAY WE *Share* WITH YOU WHAT WE HAVE LEARNED ABOUT SYNTHETIC RUBBER INSULATION

After approximately sixty years devoted exclusively to making insulated wires and cables, the skill that enables us to obtain the greatest values from new insulating materials has become second nature. That is why we so quickly developed new synthetic insulations and sheaths to replace special purpose, natural rubber compounds that have been used on Simplex wires and cables so many years.

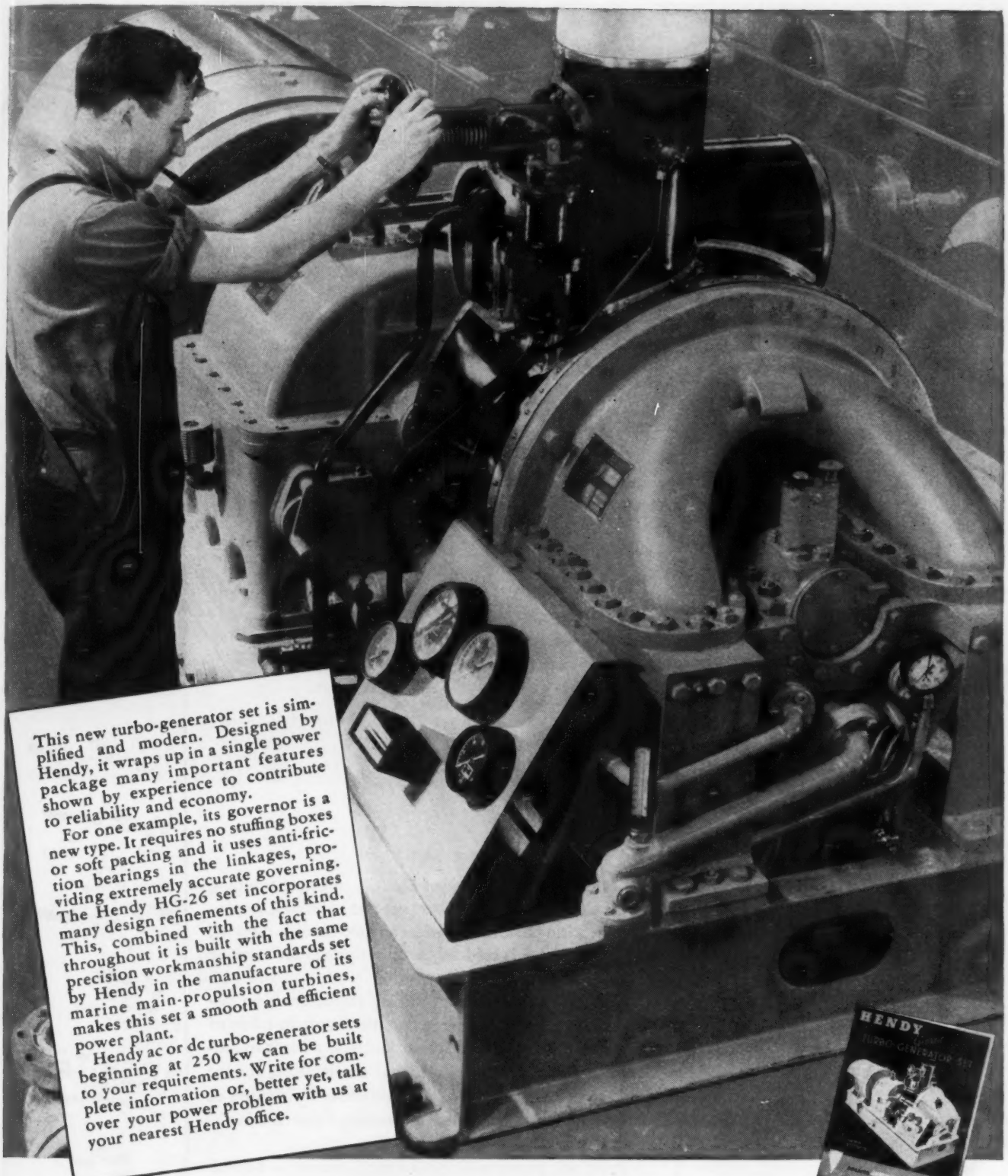
The change-over is now practically complete and various Simplex wires and cables that have been so favorably known now have synthetic rubber insulations and sheaths to replace the natural rubber compounds formerly used. Laboratory and service reports indicate that Simplex wires and cables as made today may be relied upon for the same satisfactory performance as in the past.

Because of the wide interest in the new materials we have collected the results of the work done by our chemical and electrical engineering laboratories in a booklet entitled "A Report to Industry on Simplex Synthetic Rubber Insulations." It is now being printed and we would like to send a copy to you as soon as it is off the press. Please ask for it by post card or letter to the Simplex representative nearest you or direct to us at Cambridge.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex WIRES and CABLES

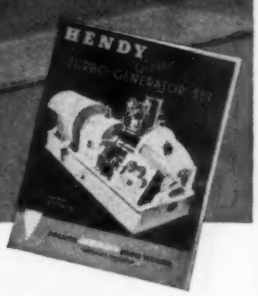
PACIFIC COAST OFFICES
390 Fourth St., San Francisco, Calif.
910 East Third St., Los Angeles, Calif.
503 Polson Bldg. Seattle, Wash.



This new turbo-generator set is simplified and modern. Designed by Hendy, it wraps up in a single power package many important features shown by experience to contribute to reliability and economy.

For one example, its governor is a new type. It requires no stuffing boxes or soft packing and it uses anti-friction bearings in the linkages, providing extremely accurate governing. The Hendy HG-26 set incorporates many design refinements of this kind. This, combined with the fact that throughout it is built with the same precision workmanship standards set by Hendy in the manufacture of its marine main-propulsion turbines, makes this set a smooth and efficient power plant.

Hendy ac or dc turbo-generator sets beginning at 250 kw can be built to your requirements. Write for complete information or, better yet, talk over your power problem with us at your nearest Hendy office.



JOSHUA **HENDY** IRON WORKS

ESTABLISHED 1856

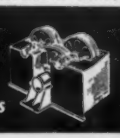
SUNNYVALE, CALIFORNIA

For complete data write for new catalog on Hendy Type HG-26 Auxiliary Turbo-Generator sets.

46-V

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES

TURBO-GENERATORS


REDUCTION GEARS

STEAM TURBINES

DIESEL ENGINES

don't straitjacket a *Good Genie*

Don't straitjacket the genie of Electricity by poor planning of the electrical wiring in your post-war buildings. Anemic circuits, wiring that is insufficient and too small in capacity, lose wattage that is paid for but never gets to the machine or appliance.

Not only must yesterday's wiring requirements be discarded as the criterion, but proper note must be taken of wiring needs far into the future. To do any less is to condemn a building to early electrical obsolescence, for the greater use of electrical equipment that is promised us will be seriously hampered in buildings that are inadequately wired.

Adequate, proper wiring is a *must*, if tomorrow's buildings are to make full use of cheap, plentiful, labor saving electricity. The Okonite Company, Passaic, New Jersey.

SAME SIZE CONDUIT

#14 #12

Wire *size* is as important as having sufficient wiring. For instance, No. 14 wire has been a standard in building for generations yet No. 12 wire will carry one-third more current, reduce voltage drop by more than a third, deliver more power for your money and yet requires no larger conduit or fittings.

ADEQUATE WIRING THE KEY TO INCREASED PRODUCTION

OKONITE and HAZARD

INSULATED WIRES AND CABLES

3608

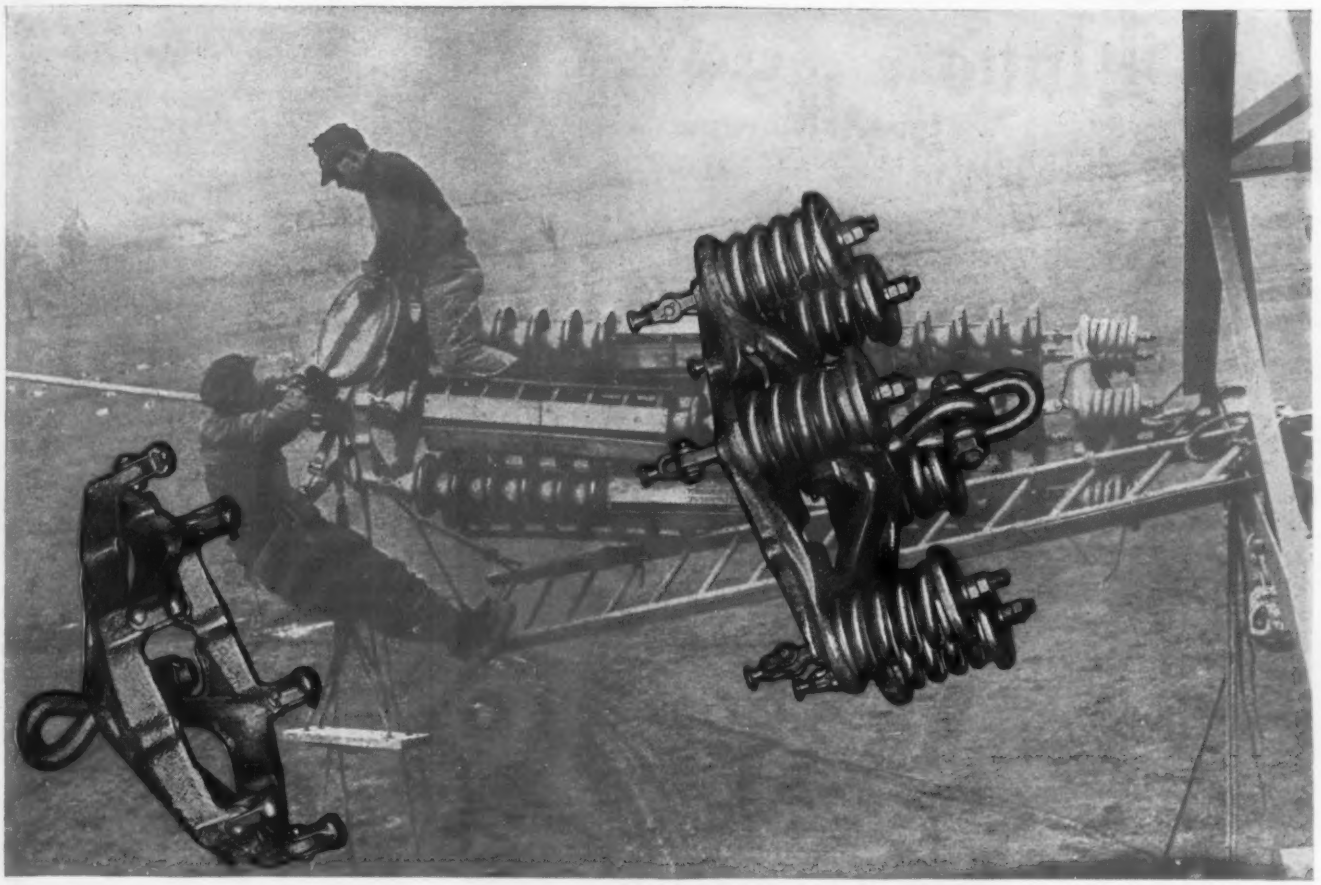
Follow THIS line of SOUND reasoning

2
+2
4

when you talk to ARCHITECTS or OWNERS

... — ✓✓

Slim and Red DON'T WORRY



Nearly six hundred feet in the air and handling six, eighteen unit strings is a job for steady nerves and experience.

But they're not worrying, and neither are the engineers who o.k.'d the B.T.C. yoke set that equalized all six strings.

Supplying transmission line hardware calls for more than production facilities; it calls for a combined knowledge of your problem and metal working.

We invite any problem in transmission line hardware.

Through Your Insulator Manufacturer Only

Transmission Line Hardware

B-T-C

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

Record Breaking Orders *Prove Trade Acceptance*

Lloyd New *Automatic* Starter

In the New RED PLASTIC Can

Submitted to Underwriters' Laboratories Inc., for approval.

Submitted to Electrical Testing Laboratories, Inc., for certification.

Pat. Nos. 2200443—2228210

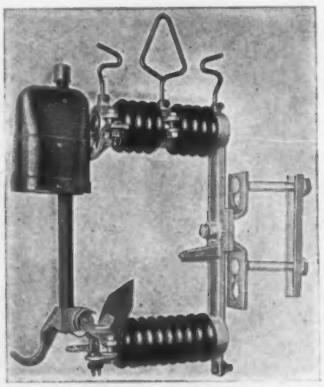
Locks Out . . . Resets AUTOMATICALLY

1. Positively cuts out deactivated, flickering, blinking lamps.
2. When trouble is detected the starter automatically cuts off current to the ballast and lamp.
3. Gives long life to ballast because defective lamp is locked out. Prevents overheating.
4. When Lloyd AUTOMATIC locks out defective lamp — turn off the current — Remove defective lamp—Put in a new lamp.
   Allow at least one minute to make the above change of lamps. Turn on the current. The starter automatically lights the new lamp.
   NO NEED TO DO ANYTHING TO THE STARTER
5. Lloyd NEW PLASTIC CAN has higher dielectric strength, is stronger, lighter, distinctive.
6. Knurled rim on plastic can insures positive grip for insertion and removal of starter.
7. Plastic can is sealed. No projecting lugs to cause trouble.
8. The life of the AUTOMATIC starter is many times greater than that of the average lamp.
9. It saves maintenance costs and power consumption, protects and insures longer life to the ballast and lamp.
10. Tested in production and prior to shipment to insure perfect performance.

LLOYD PRODUCTS COMPANY
Dept. EW-9 Providence 5, R. I.
Representatives in 23 Leading Cities.
Export Office: 13 E. 40th St., N. Y. C.

Fuseless Cutout (904)

W. N. Matthews Corp. has developed a fuseless cutout, which it states employs new principles for primary distribution protective devices, covered by its recently issued Brown-Mosley U. S. Patent 2349609. According to the manufacturer, service tests on 6,900-volt rural lines and laboratory tests have proved the performance of this cutout. It can be mounted either on a crossarm or



pole the same as an open type fuse cutout and can be furnished also for mounting on new transformers, vertically or horizontally. Ratings: 7,500 volts, 1.5, 3, 5, 7.5 kva. Thermal elements of these kva. ratings are interchangeable in the fuseless cutout. Net quantity prices delivered (not including thermal elements) are: 1 to 24, $12 each; 25 to 49, $11.28 each; 50 or more, $10.56 each. 1.5- 3- and 5-kv. thermal elements, 60c each; 7.5- and 10-kv., 80c each.

Dry Type Transformer (905)

A dry type transformer embodying induced cooling is being manufactured by Allis-Chalmers Mfg. Co. The built-in cooling system is said to operate automatically to provide extra cooling when transformers are overloaded.

The unit includes a Z-section baffle, which extends from one end to the other, channelizing air flow. When temperatures reach the overloaded level, exhaust fans cut in, forcing cool air vertically through the core structure and horizontally between the coils.

The fans are located on the top and back of the transformer and are protected by screening set flush with the metal casing which encloses the operating mechanism.

Time Delay Relay (906)

The R. W. Cramer Co. has developed a time delay relay, Model TD6, which it claims is dust and moistureproof. The bakelite case is for panel mounting. This relay has a cam operated switch mechanism. Open and closed positions are shown by means of a graduated indicating dial. There are four screw type terminals for motor and switch circuits. Switch unit is totally enclosed and has a snap action and positive lock in both operating positions, the manufacturer states.

Explosion-Proof Starter (907)

General Electric has a new line of a-c, full-voltage explosion-proof starters for use in gaseous mines, and specially designed for equipment subject to inspection by the U. S. Bureau of Mines. These starters are available up to 50 hp. in the reversing type and up to 100 hp. in the non-reversing type.

In the nation's oil fields, hundreds of induction motors have been replaced to obtain greater productive capacity. But they don't stay idle long.

"Retired" Motors Converted

TO NEW WARTIME SERVICE

Working with government agencies, Westinghouse *Manufacturing and Repair** Plants, conveniently located in every district, are making sure that this unused electrical equipment goes back to work—fast!

In these M & R Plants, wound rotor induction motors released from oil field service are converted to synchronous generators—by replacing the rotor laminations with field poles and coils. Today, these rebuilt generators are furnishing needed power to many a war industry.

This service is typical of many that Westinghouse M & R Plants are rendering today. It may suggest a new use for certain "retired" electrical equipment in *your* plant.

Every Westinghouse M & R Plant is part of a nationwide service organization—with local branches as near as your telephone. Factory-trained men, using factory methods and equipment, are ready to give you complete, dependable repair service on any type of electrical equipment.

J-90522

WESTINGHOUSE PRESENTS
. . . JOHN CHARLES THOMAS
SUN. 2:30 EWT., NBC.
"TOP OF THE EVENING"
MON. WED. FRI. 10:15 EWT., BLUE NET.

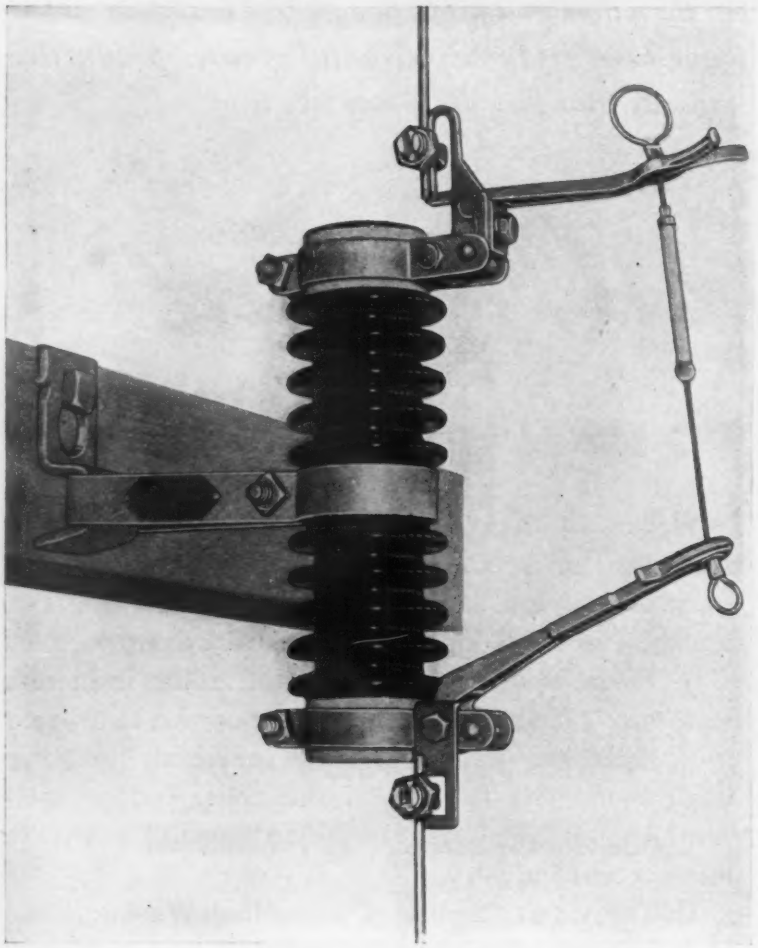
When vital electrical equipment needs repair . . . phone the nearest office of Westinghouse Electric and Manufacturing Company for

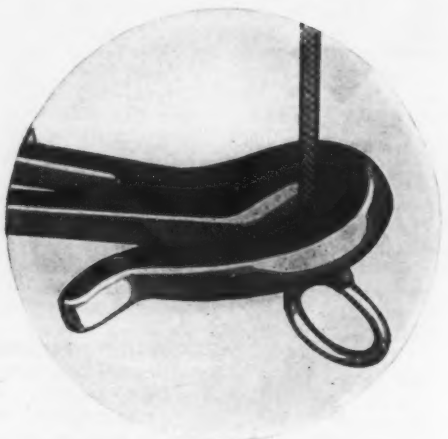
Westinghouse

COMPLETE REPAIR SERVICE

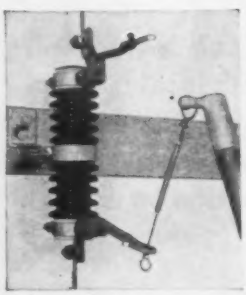
***33 M & R PLANTS • • ONE NEAR YOU**

STURDY–LOW COST MATTHEWS PROTECTOLINK CUTOUTS





Catalog 1640-50 Amp. 7.5/12.5 KV. Grd. Y — Catalog 1641-50 Amp. 15 KV.



Write for Bulletin 101-A

The design and ruggedness of Matthews Protectolink Cutouts and Protectolinks insures better performance and lower maintenance costs.

Because of the rigid construction of the contact arms they cannot be easily bent out of alignment when fusing or installing the cutout and the fact that the lower arm is actuated by an individual spring, assures positive contact tension on the Matthews Protectolink.

Note design of the contact ends of the arms. They provide easy installation and automatic seating of Protectolink buttons into the cup shaped contact recesses. No wedging of fuse link into contacts is required, thereby preventing damage to fine wires of fuse link cable. Matthews Protectolink Cutouts will also accommodate any make of open link fuse, and Matthews Protectolink Fuse Links fit other makes of open link cutouts.

W. N. MATTHEWS CORPORATION
SAINT LOUIS, U. S. A.
ENGINEERS and MANUFACTURERS SINCE 1899

YOU SAVE

...Man-Hours, Money, Materials!

Here's Power Where You Need It ... an Allis-Chalmers Dry-Type Transformer Installed Right at Load Center!

THAT 25 KVA Allis-Chalmers Dry-Type Transformer is mounted on a post—*right by* the grinder it serves!

You can put these modern units *anywhere.* There's no danger of oil leaks ... no need for fireproof vaults! Maintenance is no problem either ... without insulating liquid to test, filter or change!

Load center location gives you finer voltage regulation, lower line losses, improved motor performance—cuts need for long runs of secondary copper!

Allis-Chalmers Dry-Type Transformers are available for quick delivery ... *now!* Get the full story from our nearby district office. Or write, ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 1693

CHECK THESE TRANSFORMER FEATURES:

Smaller, Adaptable Size — permitting quick, easy changeover.

Easy-To-Get-At connections and knockouts; fast installation.

Windings Separated by solid insulation — meet safety requirements for inside buildings.

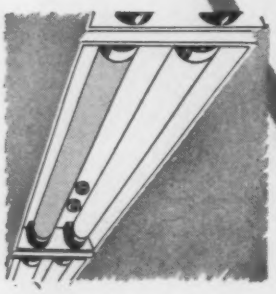
Coils Heavily Impregnated — rendering windings resistant to moisture.

Wide Range of Sizes — 1½ to 500 kva, single and 3-phase, with incoming voltages up to 15,000 v.

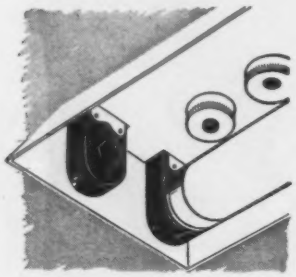
ALLIS-CHALMERS DRY TYPE TRANSFORMERS

Simplify

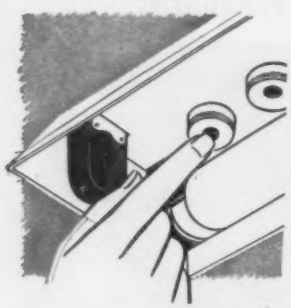
LIGHTING MAINTENANCE with G-E Watch Dog REG U S PAT OFF STARTERS



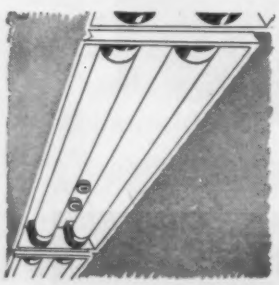
When the lamp dies the Watch Dog cuts itself out stopping annoying blink and flicker.



Manual reset button pops up eliminating futile and needless starting attempts.



When dead lamp is removed the Watch Dog is easily reset by pushing in the button.



New lamp is inserted in lampholder and it immediately begins to operate normally.

Reset It... Forget It

You can simplify fluorescent lighting maintenance to the easy job of pushing a reset button before relamping. G-E Watch Dogs eliminate the necessity of replacing a starter each time a lamp reaches the end of its useful life. This manual reset starter can outlast five ordinary starters. To relamp merely reset it and then forget it.

We can furnish you with the complete story on how to use fluorescent accessories for best lighting results. Send your request to Section G-944-18 Appliance and Merchandise Dept., General Electric Co., Bridgeport, Connecticut.

BUY WAR BONDS AND KEEP THEM

Hear the General Electric radio programs; "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.

GENERAL ELECTRIC

Connector (908)

Delta-Star Electric Co. is offering a square tube tee connector. According to the announcement, this high-ampere capacity connector has a strong gripping action secured with two distinct lines of contact at each corner of the tube, giving point by point embeddations. They are cast to size with many points of high-pressure contact.

Plastic Tape (909)

Irvington Varnish & Insulator Co. has introduced Fibron, a plastic tape which is said to have widely divergent applications. According to the manufacturer, this tape is remarkably flexible and elastic and is manufactured from Vinylite resin, product of the Carbide and Carbon Chemicals Corp. It is claimed to be heat sealing, flame resistant and high in dielectric and mechanical strength. Uses include insulation, cable splicing and protection of wiring, piping and equipment exposed to caustic or corrosive fumes, oil, grease, acids, alkalis or moisture.

A-C Voltage Regulator (910)

American Transformer Co. has introduced a new model TH transtat a-c voltage regulator. According to the manufacturer, this unit has a high rating to size ratio, and is equipped with a specially designed brush arm, a machined die casting which permits good heat dissipation, provides a simple means of changing brushes and protects the commutator against short circuiting contact with the brush holder. The shaft is independent of the brush arm assembly and can be removed by drawing one pin, it is stated.

Testing Instrument (911)

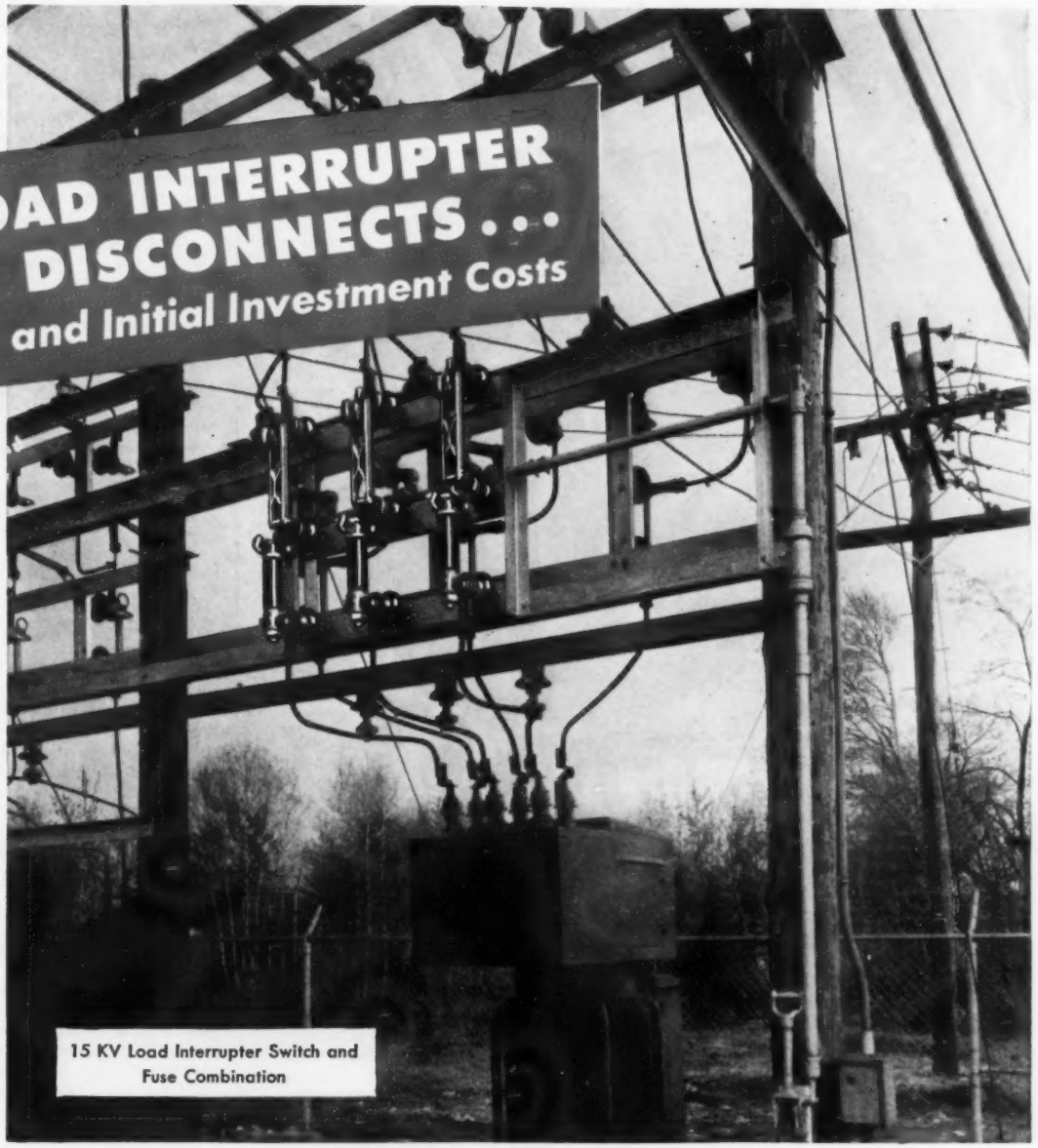
Industrial Instruments, Inc., is offering Type LB direct-indicating comparison bridge for testing resistors, capacitors or inductors in terms of ohmage, microfarads or henries, respectively. The instrument includes the main unit with separate meter on stand. The main unit is 7 x 8 x 5½ in. Net weight is 6 lb.

Shock-Proof Relay (912)

A time delay relay designed to withstand momentary shocks has been announced by the R. W. Cramer Co. According to the manufacturer, it has a cam operated switch mechanism and is particularly suited to Navy and Aircraft applications.

S&C LOAD INTERRUPTER FUSED DISCONNECTS . . .

Save Time and Initial Investment Costs



15 KV Load Interrupter Switch and Fuse Combination

Installed as *one unit*, S & C Load Interrupter Disconnects and Power Fuse Combinations as illustrated—reduce installation time and initial investment costs.

You can break loads without arcing at the main contacts, up to 400 amperes and get short-circuit protection, in one assembly. Suitable for use on 2300/4000, 6600, and 13,200 volt circuits.

Simplify your next substation installations with these S & C Combination Assemblies. Recommendations and a copy of Bulletin 202-A are both available on request.

SHORT CIRCUIT-INTERRUPTING RATINGS IN R. M. S. AMPERES

Fuse Voltage Rating→	7,500	7,500	15,000	23,000	34,500
Circuit Voltage→	2,300	4000	6,600	13,200	22,000	33,000
**SMPC-4	17,500		15,000	12,500	10,000	7,500
SMP-4	27,500		25,000	20,000	15,000	10,000
**SMPC-5	30,000		25,000	20,000	17,500	15,000
SMP-5	40,000		35,000	30,000	25,000	20,000

**Equipped with Condenser

SCHWEITZER & CONRAD, INC.

4435 Ravenswood Ave., Chicago 40, U. S. A.

Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ont.

ANNOUNCING ... the NEW

"KLEIN-KORD" TOOL BELT

THE PROVED dependability of "Klein-Kord" Safety Straps has led to the development and introduction of the No. 5204-KK "Klein-Kord" Tool Belt.

Made from multi-ply, specially woven long staple cotton, with each ply laid in rubber and vulcanized, "Klein-Kord" is a strong, yet flexible, fabric that: (1) is of uniform quality; (2) resists absorption of moisture and detrimental effects of climate; and (3) does not stretch. It has a tensile strength many times that demanded in actual service.

You'll find that comfort, safety and efficient design—important to every lineman—are built-in features of this new "Klein-Kord" Tool Belt. All workmanship and materials are of the highest quality—quality that has been typical of the name Klein since 1857.

FEATURES

1. *Positive Buckling.* Because holes can be punched in "Klein-Kord" without danger of ripping under load, a tongue-type, positive-action buckle is used.
2. *"D" Rings and Buckles* are made of solid steel drop forgings tested to 1500 lbs. to assure absolute safety. Galvanized finish prevents rust.
3. *Rivets.* All rivets are solid copper, hand set with burrs for added safety and strength.
4. *Sewing.* All sewing is done with hot waxed harness thread and lock stitched.
5. *Four Tool Loops,* conveniently located, are formed by the body strap.
6. *Canvas Lining,* 4½ inches wide, covers all rivets—an insulating feature that assures safety. Lining also absorbs body moisture to increase comfort of lineman.
7. *Metal Safety Clips,* riveted through main belt at "D" rings, prevent swing of "D" rings beyond 90 degrees from belt.
8. *Body Strap* passes through "D" rings for maximum safety.
9. *Plier Pocket* of "Klein-Kord".
10. *Tape Thong* with fibre cross bar.
11. *Knife Snap.*
12. *Handy Loop* for glove pouch.

This book on the care and safe use of tools will be sent on request.

ASK YOUR SUPPLIER

Foreign Distributor: **International Standard Electric Corp., New York**

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

KLEIN TOOLS EST. 1857

Since 1857

Synthetic Latex Insulator (913)

United States Rubber Co. has developed a synthetic rubber latex insulation for power, lighting and communication cable. Called Nubun, the insulation is made from a special modification of buna S. Its qualities are said to include flexibility, impermeability to water, laminated construction and perfect centering of the conductor to produce an insulated wire of maximum conductivity and minimum diameter. It is claimed to be exceptionally homogeneous following vulcanization and to have high electrical characteristics such as dielectric strength and insulation resistance. The special synthetic rubber compound is low in specific conductive capacity, has good aging qualities because of the presence of special anti-oxidants and will resist severe wear because, by the nature of the latex process, the rubber particles are not distorted or broken down by milling, the manufacturer states.

Plastic Foam (914)

General Electric has announced development of a new type of plastic foam which is said to be self raising and self curing. According to the manufacturer, the material is lighter and lower in heat conductivity than rock wool, glass or cork and will have many peacetime applications, especially where insulation is required. The mixture, which resembles molasses, will begin to foam or expand within two to five minutes after the mixing stops and it cures without the application of heat or any other element, it is stated. It is claimed that it will foam into 30 times its own size in about 10 minutes.

High-Frequency Generator (915)

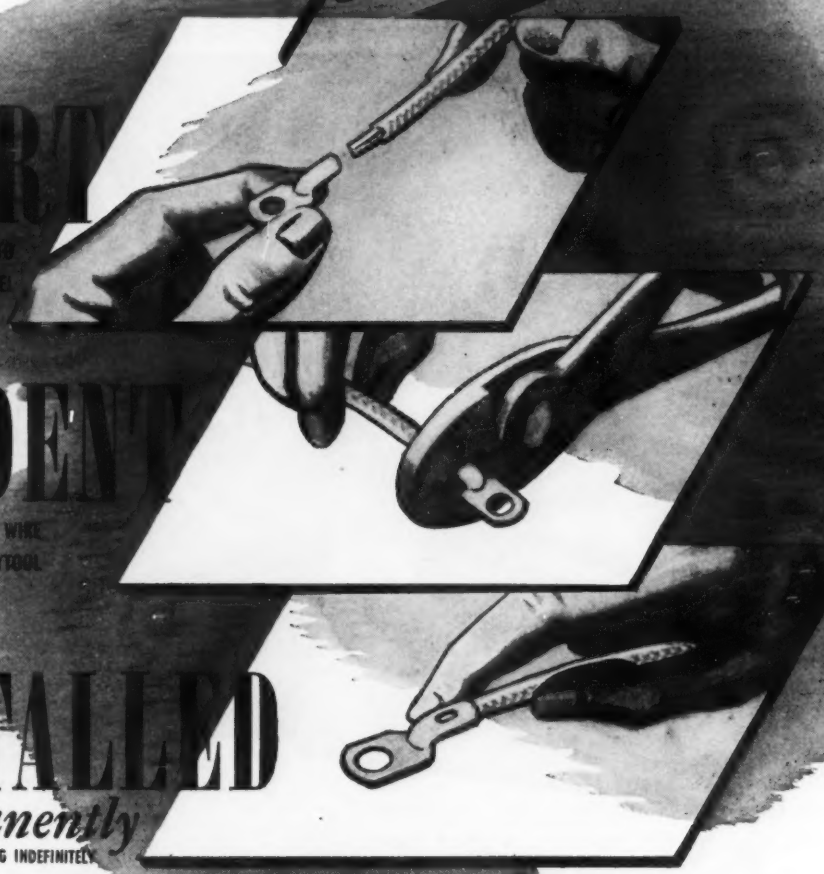
Westinghouse has announced a new line of high-frequency generators for both induction and dielectric heating loads. Ratings are 1, 2, 5, 10 and 20 kw. and units of 50 to 200 kw. can be supplied.

These units are said to be completely self contained, to require only connection to a 60-cycle power supply and to have no external cooling or other auxiliaries. Primary voltage is 220 or 440 volts, single phase for ratings of 5 kw. or lower and three phase for 10 kw. and higher.

The oscillator, power supply, blower and switchgear are housed in a single cabinet. The high-frequency section is completely shielded to minimize possibility of interference with nearby communication circuits, it is stated. An automatic timing control permits load cycle adjustment to a predetermined time, which can be repeated automatically. Terminals are provided for remote control.

HOW TO MAKE PERMANENT ELECTRICAL CONNECTIONS

permanent



★ **INSERT**
STRIPPED CONDUCTOR INTO
HYDENT CONNECTOR BARREL

★ **INDENT**
CONNECTOR TO WIRE
WITH BURNDY HYTOOL

★ **INSTALLED**
permanently
RESISTS LOOSENING INDEFINITELY

When you indent a HYDENT connector to a wire, you eliminate all doubt about the strength and permanency of the connection and its ability to resist loosening even under severe vibration. You know it's a permanently sound connection, because simple indenting compresses conductor barrel and wire into virtually one strong homogeneous whole. Further, the HYDENT connector is of pure copper one-piece construction, a feature which eliminates all extra contact surfaces, thereby assuring maximum electrical conductivity.

You'll find indenting a real time-saver, too; both for production and maintenance needs. Ask us to send you full details today.

Patent No. 2,109,837.
Listed by Underwriters' Laboratories, Inc.

Headquarters for CONNECTORS

Burndy

BURNDY ENGINEERING CO., INC.
107 BRUCKNER BOULEVARD, NEW YORK 54, N. Y.

IN CANADA: Canadian Line Materials, Ltd., Toronto 13

"No Experience Necessary"

That's a phrase we're borrowing from the "Help Wanted" columns, for it certainly applies to Bethlehem's new serving tool . . . a tool so easy to use that any lineman can learn to handle it in a few minutes' time.

As the illustration shows, the device makes possible a neat, tremendously strong serve by means of the dead-end coil method. Using a 10-foot coil of 11-gage bethanized dead-end wire, the lineman hooks one end in place on the strand; then, engaging the wire between the fingers of the serving tool, he wraps it solidly in place with a simple rotary motion. Exhaustive tests have proved conclusively that the serve holds beyond the useful strength of the strand.

After a little practice, the lineman can make his serve in about the time required to attach conventional clamps. Besides, this serve is considerably more economical than the clamp method, for a coil of the necessary wire costs less than even a single inexpensive clamp.

The serving-tool technique is especially recommended for use with *bethanized* strand and wire—manufactured by Bethlehem Steel Company. One reason is that the highly ductile, uniform bethanized coating (almost 100 per cent pure zinc, applied electrolytically) is not displaced to any harmful extent by the operation of the serving tool. Moreover, when bethanized strand and dead-end wire are used, there is no question about the holding power of the serve.

Write for more details—or, better still, ask the nearest Bethlehem representative to explain this simple, effective technique.

★ ★ BETHLEHEM STEEL ★ ★

STANDARD ENGINEERS NOTEBOOK

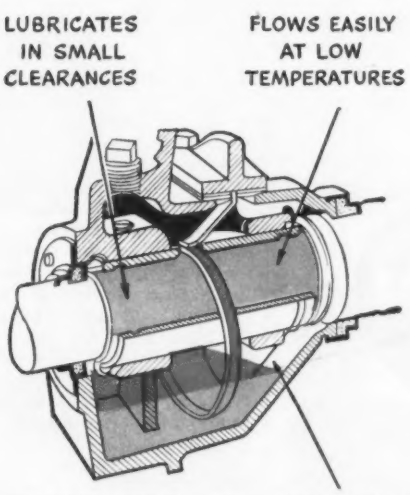
VOL. 1-E NO. 4

Lubrication of bearings on high-grade machinery

When an oil is required for the lubrication of bearings on high-speed machinery – generators, motors and other machines of that class – Calol Engine Oil 8 is recommended.

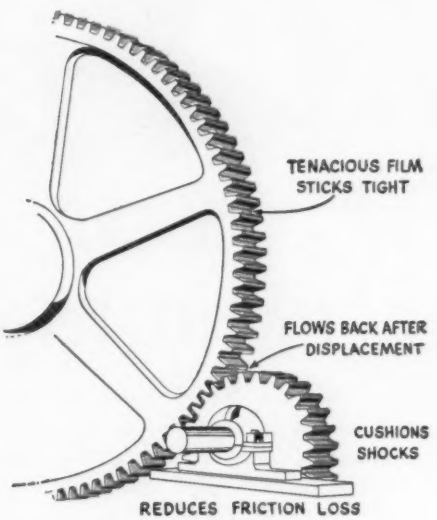
Calol Engine Oil 8 is especially suitable for bearings with minimum clearances. It may be applied by ring-, bottle-, drop-feed- and wick-oilers or by hand. It may also be used in circulating systems in which the oil is filtered and continuously re-used.

Because it is specially refined under rigid control, Calol Engine Oil 8 is always uniform and exceptionally stable in use. It is a pale, clear oil of low viscosity and a very low pour point. Its ability to spread quickly over bearing surfaces at low temperatures assures good lubrication in freezing weather.



Adhesive greases withstand heavy gear loads

Open gears may be thoroughly and successfully lubricated with Calol Pinion Greases.



Although Calol Pinion Greases have a very high viscosity, they remain fluid enough to return to gear teeth after the sliding action of the teeth has pushed them away. Their adhesive qualities keep a tenacious film on the teeth at all times. This tough film withstands pressures, cushions shocks and reduces frictional losses.

The lightest grade, Calol Pinion Grease 0, is also recommended for grease-lubricated incased gears, particularly where climatic temperatures are low.

Calol Pinion Greases are made in four grades: 0, 1, 2, 5. The heavier grades are increasingly more adhesive and in some cases require heating for correct application.

Standard Fuel and Lubricant Engineers are always at your service. They'll gladly give you expert help—make your maintenance job easier. Call your Standard Representative or write Standard of California, 225 Bush St., San Francisco 20, California.

STANDARD OF CALIFORNIA

MADE IN THE WEST

Smoot-Holman fixtures are made almost in their entirety in the large Smoot-Holman plant at Inglewood, California. Only a very few highly specialized parts are obtained from other sources and these are carefully *tested* and *certified* to be of highest quality. Our complete control of production, extending through each department of the plant, assures a quality supply available to western buyers of lighting fixtures. Our location, with branches and warehouses at strategic western points assures a *dependable* supply.

Offices in Principal Western Cities — Branch and Warehouse in San Francisco

A-C Welder (916)

A 500- and a 300-amp type outdoor a-c welder have been developed by General Electric Co. The 500-amp. unit has a current range from 100 to 625 amp.; the 300-amp. unit from 60 to 375 amp. An "idlematic" control functions to reduce the output voltage automatically to less than 30 volts whenever the arc is not in operation. The control also is provided with a switch operated by a handle projecting through the top of the case for shutting off the welder when not in use.

Dripproof construction of all openings in the top and a sealed window over the current indicator protect the unit against rain, snow and sleet, and a special finish on internal parts guards against corrosion from moist air. Ventilating openings serve to shed water and keep air velocity low, it is claimed.

Voltage Regulator (917)

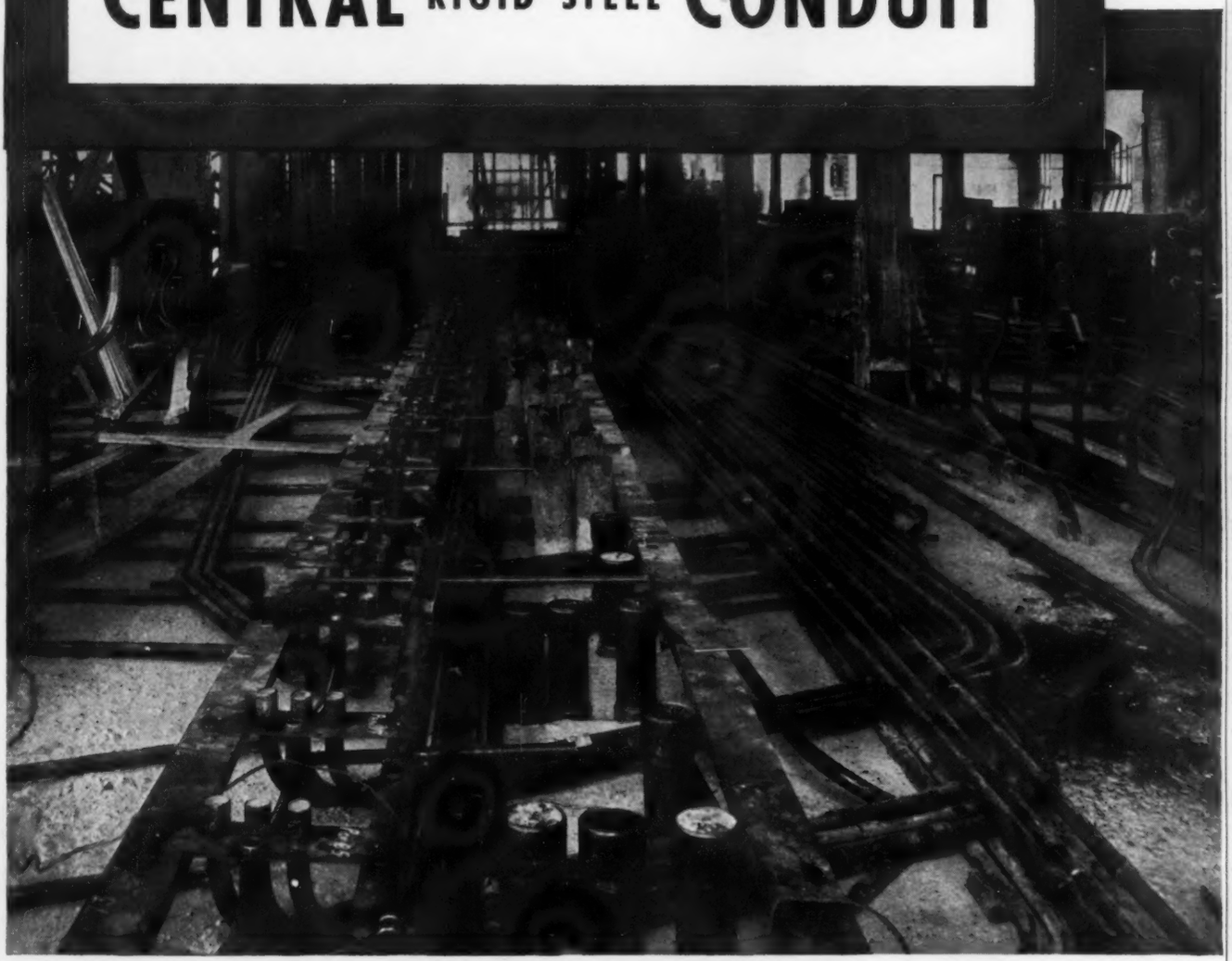
General Electric has a new voltage regulator for use with most of its resistance welding controls including the phase-shift method of heat control. It is designed to regulate the welding current automatically so that it is held constant regardless of line voltage variations of as much as plus 10 or minus 20%.

The unit consists of a resistor circuit connected to the power line which supplies the welding machine, and an electronic circuit. When the regulator is in use, the electronic circuit functions not only to hold the average voltage of the resistor current constant, but also changes, electronically, the phase control voltages of the main welding control panel. If the line voltage drops, the regulator advances the phase control voltages, thus automatically holding the welding current constant within close limits.

Tachometer (918)

R. B. Brigham Co. is offering an electrical tachometer, claimed to meet every speed measuring requirement. According to the manufacturer, by special calibrations on the indicator scale, units of miles-per-hour, revolutions-per-minute, feet-per-minute, frames-per-second, gallons-per-hour, pounds-per-minute and other units of measurement can be read. Readings on the scale are said to be guaranteed within one-half of one per cent of the full scale.

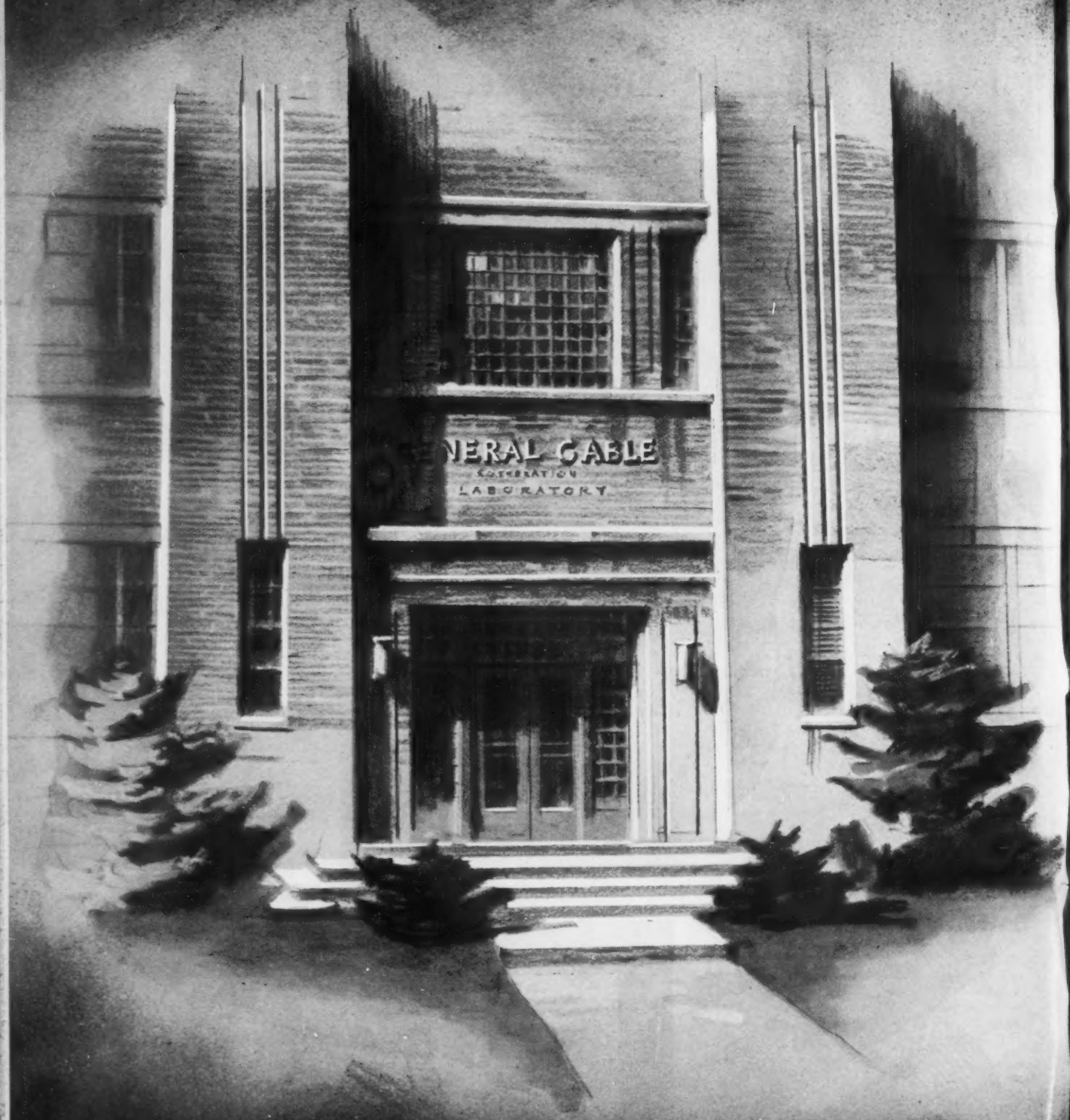
Engineering Know How
plus
CENTRAL RIGID STEEL CONDUIT



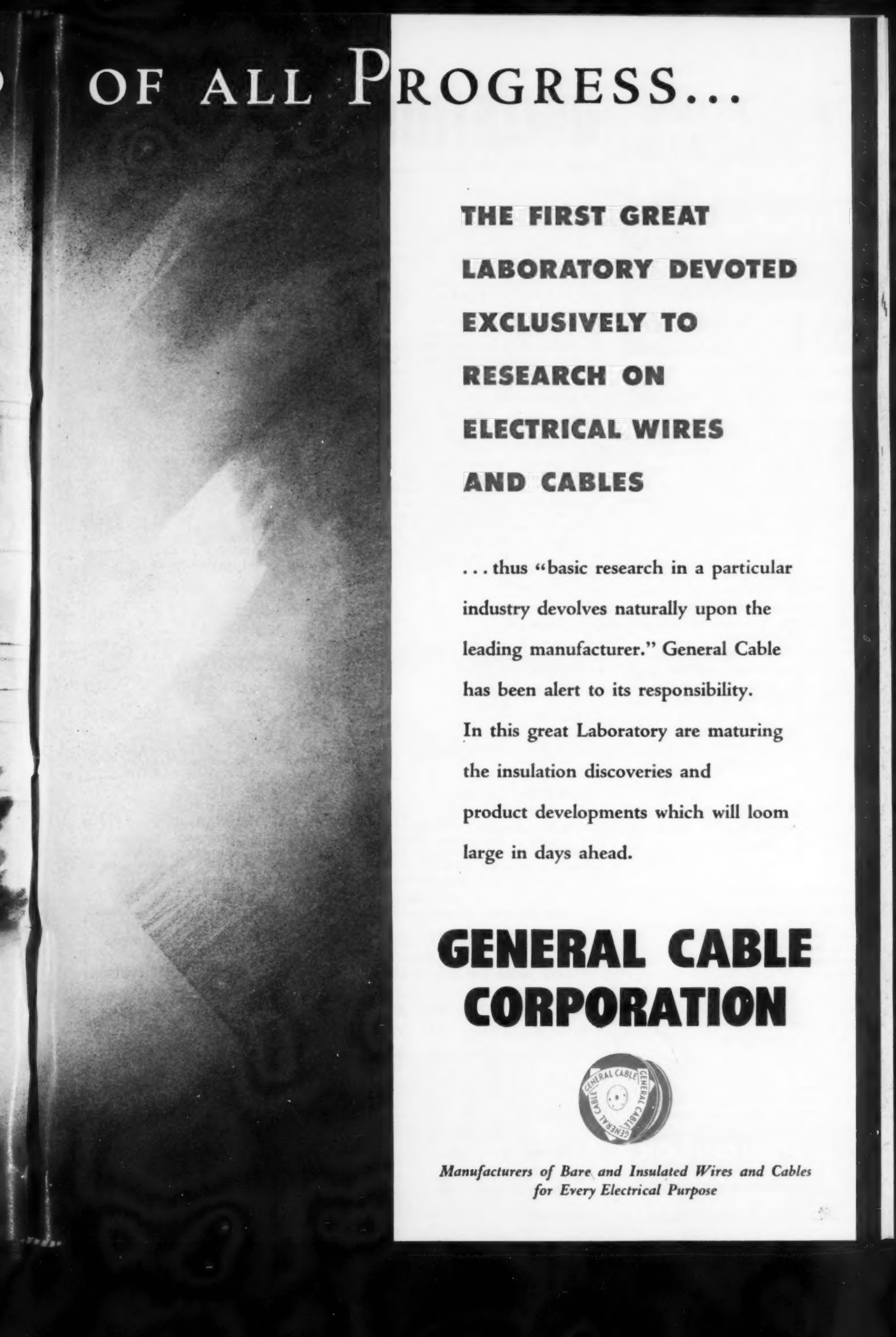
"There's Tested Strength in Every Length"

SPANG-CHALFANT
Division of The National Supply Company
Executive Offices: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

RESEARCH...SPEARHEAD



The 80 practical specialists who work in this magnificent building at Bayonne, N. J., have every facility—chemical, physical, metallurgical—to aid them in bringing nearer their goal—extending to the utmost the effective means of electrical transmission and distribution. Built in 1941, the structure has already grown to 60,000 sq. ft. of floor space—is planned for further expansion as needed.



OF ALL PROGRESS...

THE FIRST GREAT LABORATORY DEVOTED EXCLUSIVELY TO RESEARCH ON ELECTRICAL WIRES AND CABLES

. . . thus "basic research in a particular industry devolves naturally upon the leading manufacturer." General Cable has been alert to its responsibility. In this great Laboratory are maturing the insulation discoveries and product developments which will loom large in days ahead.

GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

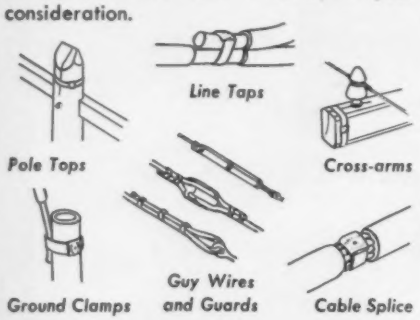
All Along the Line

PUNCH-LOK
Streamlined
BANDING and SPLICING METHOD

Saves Time in Connecting • Splicing Reinforcing • Tieing • Repairing

Using Punch-Lok, it takes but a moment to splice a cable . . . to reinforce or mend splits in cross-arms, poles and ladder rails (you don't have to take down wires or installation) . . . to make up flexible cable or solid wire line taps . . . to clamp guy wire guards . . . to connect ground wires . . . to splice cable. It is widely used for connecting hose or repairing leaks in air, water, steam, or other fluid lines. It's easy! Just put ends through clamps and use Loking Tool and your connection is made . . . or use *open end* clamps when obstructions prevent the use of preformed clamps. The connection will withstand any normal pull strain.

All along your lines, the Punch-Lok banding and splicing method saves time, work, money . . . and its ease of application and its safety factors make it worthy of your consideration.



CLAMPS... Made of flat, high tensile galvanized steel or Everdur, which is a corrosion resistant copper base alloy. All clamps are double wrapped. Available from ¾" to 48" I.D. Any large size clamp can be pulled down to fit any smaller diameter.

LOKING TOOL . . . Weight 2½ lbs. Sturdily constructed to assure long life. Locks all size clamps with a sufficient tensional pull.

For illustrated catalog and name of your nearest distributor, write Harry M. Thomas, Pacific Coast Representative, Dept. O, 1554 Oakland Ave., Piedmont 11, Calif.

PUNCH-LOK COMPANY
321 N. Justine St.
Chicago 7, Illinois

BULLETINS

data books, etc.

Welding Methods (919)

For users of arc welding, the Lincoln Electric Co. has prepared a 48-page manual covering its "Fleet-Welding" method. Fleet-Welding is said to increase speed of welding mild steel and to cut cost as much as 59%. Subjects covered include: using "arc force" to increase welding speed; effect of penetration on welding costs; cost reduction; factors affecting production speed and general information for use of procedure tables. Information on procedures for butt welds, fillet and lap welds also is included. Illustrations and procedure tables supplement the text.

Gas Turbines (920)

For persons interested in gas turbines, General Electric Co. has prepared reprints of two technical papers, "Gas Turbines and Turbosuperchargers" by Dr. Sanford A. Moss and "The Basic Gas-Turbine Plant and Some of Its Variants" by J. Kenneth Salisbury. Information includes relationships of thermodynamics, pressures and temperatures, operating characteristics, fuel economy and applications.

Transformers (921)

New designs in its constant-voltage transformers are described in a manual prepared by the Sola Electric Co.

Capacitors (922)

Sprague Electric Co. is offering a catalogue of dry electrolytic capacitors.

V-Belt Drive Equipment (923)

Allis-Chalmers has published a "quick picture" bulletin devoted to its line of V-belt drive equipment. This booklet describes five special types of Texrope V-belts—the heat-resisting Super-7 made of buna-S; oil-resisting with a buna-S belt core protected by a Neoprene rubber synthetic covering; oil-proof, made of solid Neoprene; static-resisting for grounding electric charges; steel belt, built to withstand high speeds with less stretch than conventional types.

Turbine Flow Rate (924)

Turbine flow rate measurement with the W-K principle in combination with Simplex Valve & Meter Co.'s MO meter is described in a six-page bulletin released by the Simplex company.

Plasticized Fabric (925)

In a four-page pamphlet recently released, Southern Friction Materials Co. tells about Cottonfeather, an abrasion resistant plasticized fabric.

Phenolic Plastics (926)

Design and fabrication of laminated and molded phenolic plastics and vulcanized fibre parts is covered in a pamphlet released by Continental-Diamond Fibre Co.

Resisters (927)

Sprague Koolohm wire wound resisters are described and listed in a 28-page catalogue recently released by the company.

Germicidal Units (928)

Art Metal Co. has published a new catalogue of its Disinfectaire ultraviolet germicidal units for disinfecting air in hospitals. These units utilize G-E Germicidal Lamps.

Dehydration (929)

General Electric Co. has prepared reprints of an article on home dehydration by Dr. Donald K. Tressler, originally published in the General Electric Review for April 1944.

Store Lighting (930)

"Lighting to Invite More Customers to Postwar Department Stores" is the title of one of the latest in General Electric's series of lighting pamphlets.

ELECTRICAL WEST, 68 Post St., San Francisco, 4, California

Please send me information about following CIRCLED items:

900	901	902	903	904	905	906	907	908	909	910
911	912	913	914	915	916	917	918	919	920	921
922	923	924	925	926	927	928	929	930		

Name..... Company*..... Title*.....

Address.....

* Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

Universal's "U" Plan for "V" Day is now being enthusiastically promoted by over 16,000 dealers from coast-to-coast. Two of its important features, the "Dealer's Digest" and the "100 Letter Plan" only recently announced are already being used effectively to promote post-war business.

The second phase of the "U" Plan including many new coordinated merchandising services is in preparation. Geared to your needs, they will be released at a time to aid you most. A Store Planning service will help you arrange your store for increased traffic—bigger post-war sales! Sales Training material will help you secure and train a hard-hitting sales staff.

Universal is bringing many important merchandising aids to all "U" Plan dealers. You don't have to be a Universal dealer to join the "U" Plan—just fill in the coupon now! It costs you nothing! Do it today!

UNIVERSAL

LANDERS, FRARY & CLARK • NEW BRITAIN, CONN.

LANDERS, FRARY & CLARK Dept. EW
New Britain, Conn.

Gentlemen:

I wish to become a "U" Plan Dealer—please send free "U" Plan for "V" Day Plan Book to

*Name*_____

*Address*_____

*City*_____ *State*_____

New G-E Service Training

Previous courses were attended by more than 18,000 servicemen—the *New* School will further increase the G-E dealers' lead in the postwar market.

• • •

Your distributor is organizing G-E Service Training meetings in your vicinity. He'll be in touch with you to let you know the time and place. Ask him about the "T" Plan and other G-E service helps.

Brand-new material

Much important new service information will be presented in this series of meetings. Among the features will be:

- A slide film on washer wringers. The repair procedure for the W-1000 wringer will be covered in detail. And a script book will enable you to take the story home after viewing the film.
- A slide film on the new FEA Refrigerating Unit. The major mechanical features and servicing procedure will be presented. This is a "must see" picture! Also complete with script book.
- Small appliance shop-repair manual. For the first time, in one manual, detailed shop instruction is made available on irons, coffee makers, toasters, percolators, roasters, mixers, and cord sets.
- G. E. in the Low-Temperature Field . . . Postwar. You'll get a preview of General Electric's plans for Home Freezers and other low-temperature equipment.
- New Refrigerator Operating Manual. This fine new manual covering all models is intended for customer distribution. You'll find it an excellent good-will builder.
- Discussion of Postwar business. You'll find it helpful to know of prospects for business after the war . . . and what G. E. is doing now that should help in the postwar era.
- And many other additional subjects, both new and review, crammed full of profitable information.

Movies, slide films, and expert instructors will give a review of major appliance repairs . . . high spots taken from previous courses.

"T" Plans

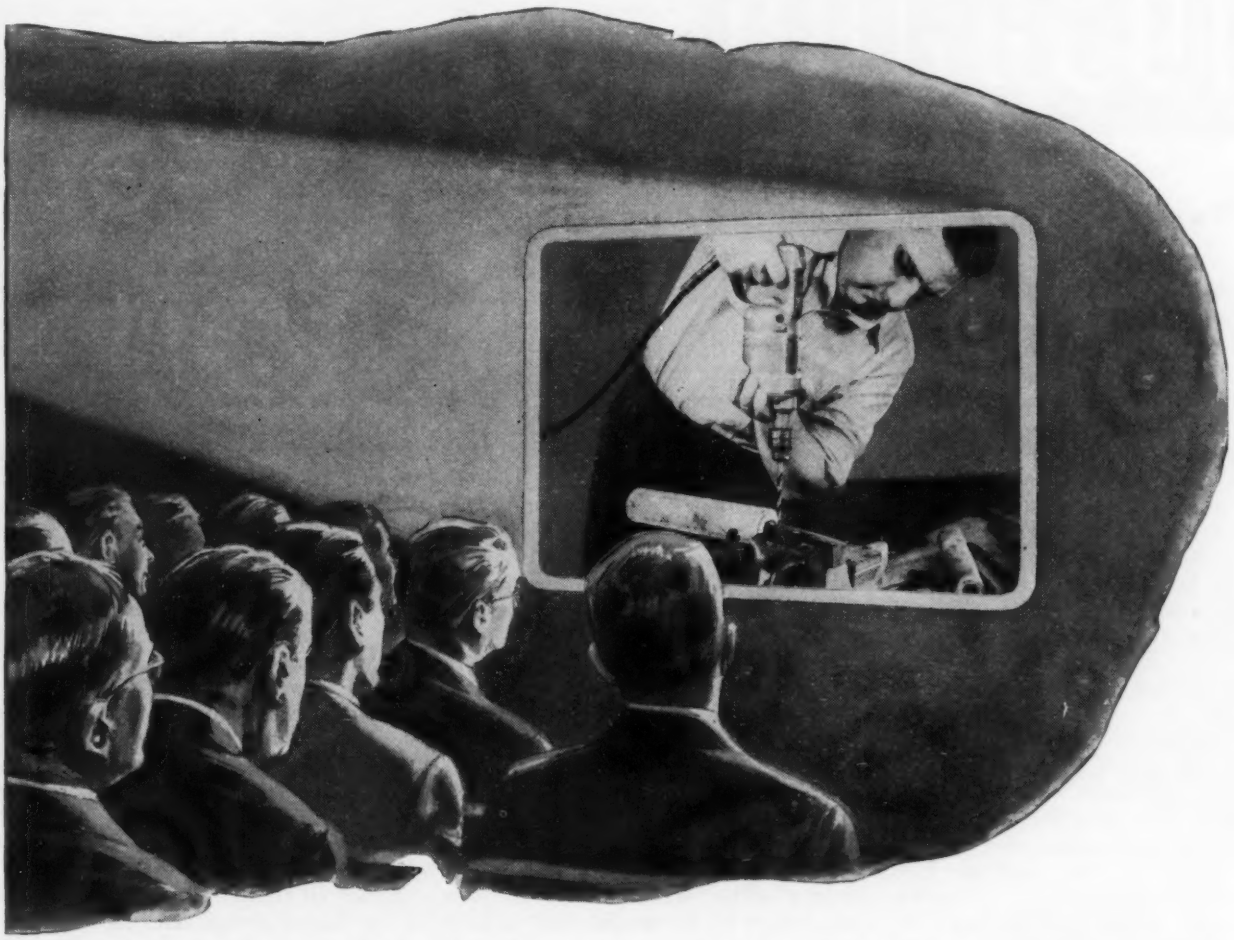
General Electric has left no stone unturned to provide every bit of information needed to make service business profitable. The "T" Plans are another example of this. These are the home-study courses . . . already taken by more than 4000 servicemen.

The first "T" Plan covered G-E refrigerators. It was received so enthusiastically that it was followed up by a Plan on G-E ranges. General Electric plans to continue this practical form of instruction.

Plus plenty of printed helps

General Electric has spared no expense to provide complete guides for your service work. First, there's the "PRODUCT MAN"—a monthly service magazine which totalled more than 500 pages of valuable service aids in 1943. More than 4000 dealers get this

School starts in October



magazine. Be sure you are a subscriber. Price, $1.50 per year.

In addition, there's the new service manual on G-E Scotch-Yoke refrigerators. And, of course, there's the Appliance Service Handbook—a 214 page service story on all General Electric major appliances. More than 10,000 copies have already been distributed.

No matter what G-E product you're interested in, there's service information available.

An opportunity you can't afford to miss

These new G-E Service Training meetings will help you make the most of your repair business now and after the war. They have been planned to bring you a wealth of service information on many G-E lines.

The postwar battle for business is bound to be a hard one. General Electric is offering you the opportunity to get set for a bigger share of the appliance business by training yourself now. ***General Electric Appliance and Merchandise Dept., Bridgeport, Conn.***

TUNE IN: *"The G-E All-Girl Orchestra," Sunday 10 p. m., E. W. T., NBC. "The World Today" news, every weekday, 6:45 p. m., E. W. T., CBS.*

FOR VICTORY

General Electric is working night and day to speed the attack.

You can help, too, by buying and holding more War Bonds than before.

Everything Electrical for After-Victory Homes

GENERAL ELECTRIC

ELECTRA'S HUSBAND

Bathrooms vs. Kitchens

"THOSE friends of yours from Chicago, the Rosses, think we are bathroom crazy out here in the West," Electra said to me one evening recently as we sat waiting for the 9 o'clock news.

"What does she mean, bathroom crazy?" I asked.

"She thinks we do most of our living in bathrooms," Electra answered. "I guess she bases her opinion on all of the tile work, modern conveniences, fancy decoration, glassed-in showers and gadgets we have in our bathrooms."

"What got her off on that subject?" I queried.

"Well they have been looking for a house to rent or buy ever since he was transferred out here," Electra said. "You know he works for one of the appliance companies and she is very kitchen conscious. She said she had been looking for weeks for a house with a really modern kitchen and all she found were flossy bathrooms. You ought to hear her tell about some of them."

"I seem to remember that Ross mentioned that she won a kitchen planning contest once," I commented. "That would account for her interest. But let's hear more about the bathrooms."

"She told me about one place down the Peninsula," Electra said. "It had two bathrooms that must have been something from her description. In one there was one of those square affairs with the tub set into it on a diagonal. There was even a place to sit down. Then the whole thing was encased in glass so as to make a shower too. The glass was etched and the trimmings were all shiny plating of some kind. There was a pedestal washbasin, and there were built-in cupboards for both clean and dirty linen. The whole thing was done in two shades of green tiling."

"Some class," I said.

"The other bathroom was even more luxurious," Electra continued. "The washbasin was just part of a long dressing table that ran along one whole side of the room. There was one of those diagonal tubs too, but the shower was separate. There were fluorescent lights around the mirror and there was a sun lamp built into the ceiling. The tiling was pink and white."

"Yea, but how about the kitchen?"

"It was terrible," Electra answered. "The space for the refrigerator was too small. It would only take one of those little boxes. There was no wiring for an electric range. The sink was not convenient either to the range or the refrigerator. And there was only one little light in the ceiling. Besides the house had no laundry."

"What could she expect with all the money spent on the bathroom?" I said as a sort of aside.

"But there was a house over across the bay where the bathrooms were even better," Electra continued. "There was an outlet for the telephone in one of them . . ."

"That must be what the woman in the apartment downstairs has," I interrupted. "Only something like that could account for all the talking she does in the bathroom."

"Does it disturb your reading?" Electra asked maliciously. "In case you'd like to know she has a long cord on her phone so she can take it all over the apartment. I asked her about it. But this bathroom in the house Mrs. Ross looked at had a little wicket window along side the tub which opened out into the kitchen. Neither of us could decide what that was for unless to get drinks. Then there was a glass receptacle built into the wall sort of high up with hot and cold running water piped to it. She said they had them in French bathrooms. It had a . . ."

"Yes, I've seen one of those so let's forget it," I cut in quickly. "But what was wrong with the kitchen?"

"Why almost everything," Electra said. "There were only two little fluorescent lights, one over the range and the other up under one of the cupboards. The woman who owned the house wanted to take them with her if she sold the place. The whole kitchen lacked any planning, according to Mrs. Ross. She said a woman would walk her legs off trying to keep house. And this kitchen wasn't wired for an electric range either. You'll have to ask her yourself about some of the places she saw. And you'll have to tell her why the bathrooms around here are so glamorous too."

"That's easy," I said. "It's a conspiracy."

"I don't get what you mean," Electra said.

"You ought to; you're part of it. By you I mean the public. It's a conspiracy between the manufacturers, the plumbers and the builders to sell you a real package. And they have done it to perfection. So much so as a matter of fact that you, representing Mrs. John Q. Public, look at the bathroom almost before you look anywhere else in a new house. Think back before the war. Remember that Crane Company exhibit down town? How many model bathrooms were there in there? You ought to know because you looked a dozen times."

"I know," she said. "There must have been at least twenty."

"Did you ever see any displays of model kitchens like that?" I asked. "I'll answer for you. No, never. Perhaps one. No, there were three model kitchens in Meier and Frank's up in Portland that time I took you through the store. What was the most attractive display in the block where the power company offices were here in town? Was it kitchens?"

"No, it was bathrooms—two doors down the street," Electra answered.

"Every little plumber had at least one swell bathroom set up in his shop," I continued. "How many electrical contractors or electrical dealers could do as well? Yes, it was a conspiracy all right. One of the best sales promotional conspiracies in the building business. It was the finest job of packaged selling ever conceived. No wonder we seem bathroom crazy."

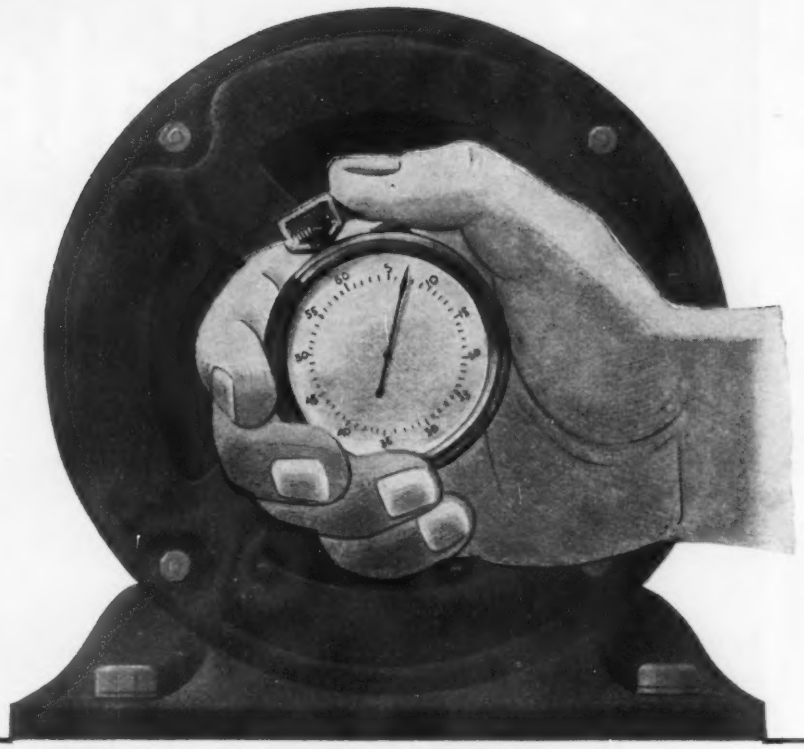
"There is another reason too that you've forgotten," Electra said. "It's the pre-Victorian plumbing you find in so many of the old places in this town. When people do build or buy a new home, they remember what they have had to put up with and they go in for everything in the book."

"Why shouldn't they want to do the same thing with kitchens?" I asked. "I guess we have done a darned poor selling job. But anyway it's a good postwar opportunity. By the way, didn't I hear that the Rosses bought a house? What kind of kitchen has it?"

"A beauty," Electra said. "It had just been remodeled before the war.

"How about the bathrooms?" I asked.

"As soon as the war is over, she's going to have them remodeled," Electra said. "Glass doors on the shower and everything else."



How to get more horsepower per hour!

It is a proved laboratory fact that long-fibred greases have high internal friction which will cause a measurable drag when used in electric motors.

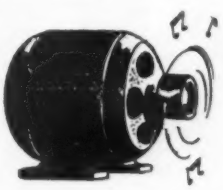
To get the full potential of motor output, many Western manufac-

turers lubricate their equipment with BALLROLL—the grease especially designed for electric motors.

BALLROLL is a short-fibred grease with low internal friction. It shears easily, allowing the motor to run with a minimum pay load loss. BALLROLL resists temperatures as high as 350° F.! It adheres to bear-

ings for indefinite periods, resisting throw-off.

Because of its low frictional qualities, BALLROLL actually allows your motor to develop more horsepower than is possible with the average grease. Equipment lasts longer—is better protected.



You can have a supply of this low-friction, long-lasting grease delivered to you by phoning your local Union Oil Company representative.

BALLROLL

Another
UNION OIL
Success-Tested Product

111
333
888
711-A
733-A
111
333
888
711-A
733-A

Numbers that mean immediate circuits

THERE is no wiring problem when "Metal Molding" surface raceways are used. The wires are laid in the base; the capping snaps on. It's as simple as that to eliminate fishing and tearing up walls or floors to install additional circuits.

"Metal Molding" is manufactured in three sizes; 111 "Xtensionduct" carrying two No. 14 wires, 333 "Metal Molding" for four No. 12 or 14 wires and 888 "Metal Molding" used for carrying ten No. 14 wires for branch circuit feeds. "Florduct" for surface wiring on floors comes in two sizes. 711-A "Florduct" has capacity for three No. 12 or No. 14 wires and 733-A "Florduct" carries cable up to two 26 pair. All five raceways are interconnectible with each other. These neat appearing surface raceways have a complete line of fittings having two or three different sizes of twistouts to take the various sizes of moldings.

All have a neutral gray finish which may easily be painted with either oil or water paints to match interiors. For that quick surface wiring job, use "Florduct" and "Metal Molding."

Listed and approved by Underwriters' Laboratories, Inc.

Write for catalog and handbook.

National Electric Products Corp.

Pittsburgh, Pa.

NATIONAL ELECTRIC PRODUCTS CORPORATION, BRANCH OFFICES

1401 South Hope Street
Los Angeles 15, California
Phone Prospect 2003

400 Potrero Avenue
San Francisco 10, California
Phone Underhill 1145

1948 Sixth Avenue, South
Seattle 4, Washington
Phone Eliot 3776

ELECTRICAL WEST

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STATES' RIGHTS IN PUBLIC POWER PROJECTS

Alfred M. Cooper

FOR a good many years the right of the federal government to build flood control, reclamation, water supply and power generating dams in any section of the country it might deem advisable has gone unchallenged. The assumption has been that such projects were conceived and executed in the public interest, and any inconvenience suffered by those citizens whose farms and homes happened to lie in communities adjacent to these developments was far outweighed by the benefit derived by the larger number of people who were served by the projects.

Recently, however, a number of more or less unrelated occurrences in widely divergent areas of the country indicates that there is arising a tendency on the part of our citizens, not only to scrutinize carefully the teeth of these governmental gift horses, but to resist accepting such seeming gratuities at all.

One example of this has occurred in southeastern Vermont, where an indignant populace is fighting the government's proposal to install a flood control dam and power generating plant in the West River Valley of that state. The Vermonters favor the flood control dam, but believe their own state, and not the federal government, should build it. They are definitely opposed to the construction of the 30-million-dollar hydroelectric plant that has been tacked onto the flood control plan.

An even greater furore has developed in the Far West over the treaty with Mexico recently publicized by our State Department, which allocates to our southern neighbor a guaranteed annual minimum of 1,500,000 acre-ft. of water from the Colorado River system, and which further proposes the construction of a number of reclamation, diversion, flood control, and power generating dams along two border river systems, the Tijuana and Rio Grande. In this instance the strongest conceivable opposition to the entire project authorized by this treaty has developed in California, and Nevada and Arizona also stand to lose heavily if the Senate ratifies the treaty in question.

Vermont citizens, in opposing the construction of the West River Valley project, have called attention to the fact that many federal flood control dams now in operation do not serve to protect the lands in their vicinity from disastrous floods, and assert that this is true because these dams are operated primarily for the benefit of the hydroelectric generating plants that are invariably included in the appropriation for flood control projects.

The gigantic series of developmental projects authorized by the unratified treaty with Mexico brings into the picture a new and unpleasant feature connected with these public water and power developments. In this instance there has occurred a definite effort to ignore the provisions of a contract previously entered into between our federal government and those Western states served by the Colorado River project. James H. Howard, general counsel for the Metropolitan Water District of Southern California, sets forth three pertinent facts connected with the effect of the Mexican treaty as follows:

1. The pending treaty with the United Mexican States would constitute a breach of the statutory agreement between the United States and the State of California, evidenced by the Boulder Canyon Project Act and the California Limitation Act.

2. Water delivery contracts of the United States, executed by the Secretary of the Interior with water users in California, under authority of the Boulder Canyon Project Act, are not, by reason of reference to the Colorado River Compact, or otherwise, subject to agreed diminution to accommodate a treaty with Mexico.

3. As against such diminution the California water delivery contracts are firm, not only as to 4,400,000 acre-ft. of water apportioned by Article III(a) of the Colorado River Compact, but as to one-half of excess or surplus water unapportioned by the compact. Such excess or surplus is to be measured in the light of the language of the Boulder Canyon Project Act and the statutory agreement between the United States and the State of California, that is, without extension of the benefits of storage at Boulder to the service of Mexico.

The unratified treaty with Mexico proposes to obligate the United States, with reference to the Colorado River:

1. To allot to Mexico a guaranteed annual minimum of 1,500,000 acre-ft. of the surface flow of the river, to be increased, when water is available unused in the United States, to 1,700,000.

2. To deliver until 1980, 500,000 (and thereafter 375,000) acre-ft. of the guaranteed 1,500,000 through the All-American Canal and the remaining 1,000,000 (or 1,250,000 after 1980) in the bed of the river, at the boundary. This water is all to be delivered according to certain schedules, but practically as and when ordered by Mexico.

3. To give Mexico a share of the net revenues of the Pilot Knob power plant on the All-American Canal.

4. To construct, operate and maintain, at its own cost, the Davis Dam, which will be used, in part, to regulate the comparatively equal monthly discharges from the Boulder power plant so as to meet the unequal monthly needs of Mexico.

5. To permit Mexico to build a permanent diversion dam at any point below the California-Mexico boundary. This Mexico is forbidden by present treaties to do.

6. To construct or acquire, and operate and maintain, all works needed to deliver water to Mexico.

The total water supply in the Colorado River basin is subject to alternating wet and dry cycles of from

seven to eleven years. It is estimated by the Bureau of Reclamation upon studies of stream flow over a 44-year period, that the average outflow from Boulder Dam in the future, during critical dry cycles extending over ten or more years, will be 8,500,000 acre-ft. per year. The supply and draft thereon is estimated as follows:

Supply	Acre-Ft.
Outflow from Boulder Dam	8,500,000
Reservoir and other river losses below Boulder Dam	600,000
Available for use	7,900,000

Requirements	Acre-Ft.
Nevada Contract	300,000
California Contracts	5,362,000
Arizona Contract	2,800,000
Proposed Mexican Treaty	1,500,000
Total	9,962,000
Available Supply	7,900,000
Requirements	9,962,000
Overdraft	2,062,000

From the above summary covering available water from the Colorado River and the demands that the new treaty with Mexico places on this water, it is obvious not only that the Western states involved will suffer serious loss of essential water if this treaty should be ratified, but that there will also occur a definite breach of contract between the United States and those states that were to benefit under the provisions of the Boulder Canyon Project Act and the Colorado River Compact. In view of this situation, it is not surprising that these states, and particularly California (the largest consumer of Colorado River water under existing agreements), are prepared to fight the ratification of this treaty with every means at their command. Especially do these states resent the fact that water urgently needed in a great American agricultural area is to be diverted to one of the most sparsely populated sections of Mexico; a section with but few potentialities for agricultural development.

Another and somewhat different instance of the tendency of the various states to question the supreme authority of the federal government in matters pertaining to power development and regulation was cited in a recent issue of *Public Utilities Fortnightly*. In this case the National Association of Railroad and Utilities Commissioners went on record as opposing attempts of the Federal Power Commission to overstep its powers in interstate commerce matters, and in attempting to usurp the regulatory powers of the states. As we shall see, this situation is directly related to those we have been discussing, since *no matter what reason is advanced for the construction of any federal dam, or series of dams, the underlying purpose of all such projects appears to be that of expanding the growing network of publicly owned hydroelectric generating stations and transmission lines.*

The conception and construction of these public power projects follow a pattern that should by now be familiar to everyone. The great dams that must be constructed before hydroelectric power can be generated are, in each instance, justified to the public either as essential units in irrigation projects that will reclaim thousands of acres of arid lands; as being vitally necessary instruments of flood control; or, as means of furnishing additional water supply to nearby cities. But no matter what reason is advanced for building these dams, invariably there is appended to the appropriation of the construction of each, authorization for the installation of mammoth million-horsepower electric generating plants. The power from these completed plants is then to be distributed by a network of government-owned transmission lines and eventually sold to municipally owned power bureaus, or to public utility districts organized by governmental agents in communities in the vicinity of the dam.

The low-cost, tax-free power generated at these flood control or irrigation dams is the basic element in the plans of the proponents of public power to undercut private enterprise in the public utility field. The fate of the electric power companies operating in the Tennessee Valley district is only one example of this. Part of the generating facilities at Boulder Dam has now become just another power house for the largest municipally owned electric system in the country. Bonneville and Coulee are generating millions of kilowatt-hours of power, much of which is temporarily allocated to war industries of the Pacific Northwest, but the major portion of which would eventually be utilized by government-sponsored public utility districts within territory now served by the privately owned power companies of Oregon and Washington, if the public power proponents have their way.

Consideration of the Mexican treaty by the Foreign Relations Committee of the Senate was originally scheduled to begin on May 1 of this year. Now these hearings have been postponed indefinitely, and it is quite possible that no action will be taken regarding the ratification of this treaty until after the November elections. As matters now stand, there is every reason to believe that a complete airing of all the implications involved in this treaty, not only as regards the ceding to Mexico of water rights already granted by the federal government to our Western states, but concerning the enormous development of publicly owned electric power contemplated by the treaty on the Colorado and Rio Grande Rivers, will result in the refusal of the Senate to ratify this treaty.

It must also be borne in mind that there are now in operation in various parts of the country many successful flood control projects that have been built entirely with state and county funds, and in which all emphasis in design, construction, and operation is placed upon flood control alone. In these projects no effort has been made to install power generating stations in connection, and it is therefore possible to devote the dams and catch basins exclusively to the purpose of impounding water in time of flood.

The privately owned electric utility of today is making an earnest effort to serve its community competently and fully. It is doing a splendid job in aiding the war effort. It deserves the wholehearted support of every individual who favors free, private enterprise in American business. In repayment for all this, the business-managed power company finds itself in direct competition with the government its taxes help to support, and often has its very existence threatened by the activities of agencies of that government.

It is important to bear in mind that what has happened to the private utility corporation can happen to any other corporation in America. If government can put the power company out of business, it can also put the manufacturer out of business. Perhaps the most important outcome of the Montgomery Ward affair was the rude awakening of many business men to the fact that what was happening to Sewell Avery today could happen to any one of them tomorrow. In the future there will be much less tendency on the part of American businessmen to consider that governmental interference with the private electric utility's affairs is a matter of concern only to the management of that utility.

In any case, it is encouraging to note that, in widely scattered sections of the country, there is developing a tendency among our citizens to question the wisdom of federal expenditure of enormous sums for the construction of additional dams designed primarily to furnish more and more units in a nation-wide network of publicly owned electric generating plants. It may well be that this and other issues involving uncontrolled governmental spending may finally resolve themselves into a simple question of states' rights, and be decided by the Congress on that basis.

LIGHTING

comes to the Hour of Decision

Symbol of a changed lighting world is the retirement of the last arc lamp in Portland, which came down in June to be replaced by incandescent. Incandescent, too, is challenged by younger light sources, and the days after the war will be filled with activity and competition between light sources as well as men. In the picture, C. J. Snyder of Portland General Electric Co. takes down the old veteran while John Heisler waits to put it away

JUST as war has brought change to almost everything, it has brought it to lighting. War treated lighting to extremes. It dimmed light down almost to blackout, and it pumped it up for war production to levels that the industry hoped to attain but hardly dared believe could be accomplished.

In the urgency for more light from less critical materials, war gave impetus to daring experimentation and development. Light sources, in particular, were given new pressure to grow. Fluorescent lighting advanced with blitzkreig speed. Cold cathode, known only for sign lighting before the war, has emerged, not only for custom-made but for packaged lighting. Mercury sources have increased in number and importance. Lighting data manuals of before the war are out of date today, because they lack information as to these new developments.

Figures released by the War Production Board on 1943 shipments of lighting fixtures reveal what a change has taken place. In 1939, according to the census of manufacturers, the production of lighting fixtures totaled $35,328,000, and most of it was of incandescent types. In 1943, the total was about the same, $35,200,000, of which only $15,000,000 was in incandescent, while $20,000,000 was fluorescent.

These new sources present a dilemma to the industry, one which will call for bold decision in the days immediately following the war. The newer sources all deliver more lumens per watt. They all have longer life.

To the utilities, the first is a threat to the load, just when they might have hoped to use lighting as a load restorer when some of the heavy war production industrial load falls off.

To the lamp producers, the latter is a threat to their volume. Because of this volume they have been able in the past successively to reduce the cost of lamps.

To the fixture industry and the installing contractors and the illuminating engineers and designers, this trend is a threat of chaos and confusion.

Such threats, however, are for the timid. To the bold, these changes open opportunities. There is a challenge in these changes.

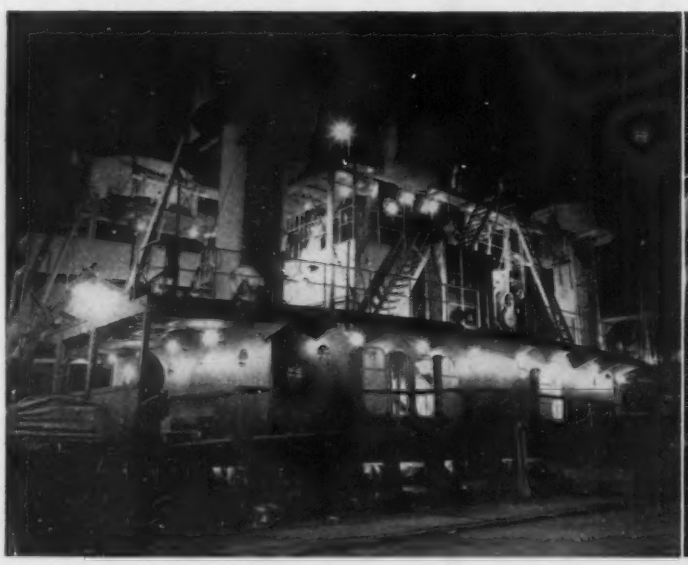
If the decision is courageous, a new era of lighting is about to open. The industry will seize these new tools and work them hard to produce higher and still higher levels of light and thus, by action, create more load and business than they lose.

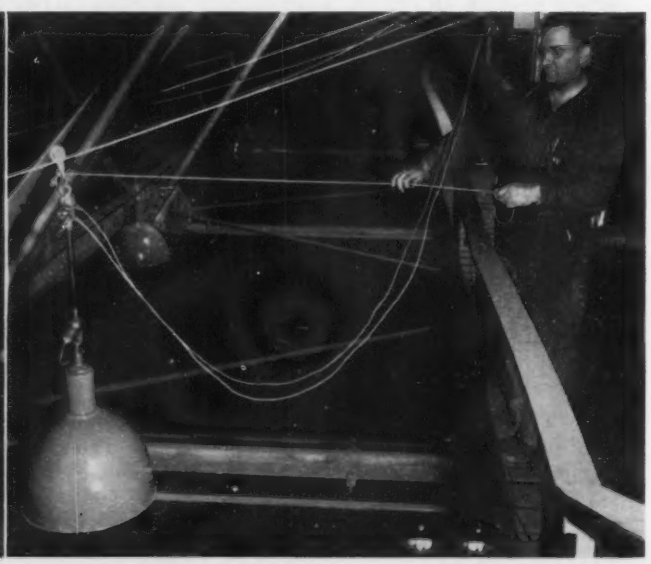
For light there is no turning back. The sky, truly, is the only limit.

And in the following pages the tools for tomorrow's relighting, the available light sources, are briefly appraised and reviewed, the better to understand the many opportunities they contain

INCANDESCENT

Most versatile and easiest maintained is old reliable incandescent. To make it easier to relamp in Grand Coulee's 8½ miles of tunnels and galleries inside the dam, the tricycle above was devised. At left, top, general lighting of 20 f-c from 300-watt silver bowl lamps in RLM domes, plus 100-watt silver bowl in local lighting for 125 f-c on the work at Charles L. Bailey plant, San Francisco. Center, warehouse at Vega Aircraft, Burbank, with 15 f-c from over 500 Westinghouse Locklite incandescent fixtures with 500-watt lamps, 20 ft. high mounting, 15 ft. centers. Lower left, prefabricated deck house section for a tanker at Marinship yard, in Sausalito, where stringers of temporary lamps serve for night shift construction illumination. Below, for relamping high-bay industrial units from a catwalk, the safe-change hanger, suspended on a trolley from a cable, can be pulled easily to the catwalk for service. The uses of incandescent lamps are legion and the equipment to house, control and direct the illumination produced by the incandescent filament is varied





INCANDESCENT

Far from becoming obsolete, the incandescent filament lamp will always fulfill some purposes better than any other light source. Likewise it will continue to be used and be preferred for many applications where newer light sources might also be considered, because of the economy, flexibility, ease of maintenance and convenience of incandescent lamps and accompanying equipment. Improvements in incandescent lamps will continue too

LIGHT SOURCE SELECTION GUIDE

Characteristics

The incandescent filament lamp may be considered as a point source, or concentrated source, enclosed in its own glass envelope, operating as a self-contained unit, easily removed and replaced. The light it gives is richer in the red and yellow portions of the spectrum than in the blue and violet.

Advantages

Convenience is first. It is available nearly everywhere, is easily replaced, cleaned, or moved, is light in weight, small in size. It requires no auxiliaries or ballasts, operates at or is available at all standard voltages. For concentrated beam or for accurate control of light distribution, its point source is more easily worked with. It is the familiar light source that has been in use for practically all purposes during the past 55 years. It is capable of being dimmed without going out. It starts instantly and stands repeated starts better than all sources.

Disadvantages

Its color is too rich in the red and yellow. Its efficiency per watt is relatively lower than newer sources. Much of the wattage input goes into heat, which must be dispersed or dissipated.

Fixtures

An extensive variety of light control equipment has been developed for shielding, controlling, diffusing and utilizing the light from incandescent lamps. (Consult catalogues.) These are available in glass (both mirrored and prismatic), aluminum, enameled steel plastics.

Availability

Twenty American manufacturing companies are listed in the Electrical Buyers Reference, with as many more trade names. Standard sizes, voltages and types are available generally everywhere. Special types, sizes, filaments or voltage lamps can be manufactured on order in normal times.

Future

Because of low cost, interchangeability, ease of maintenance, quick replacement, ruggedness, flexibility and accuracy of control, filament incandescent lighting will always have a wide application and field of use. It will continue to be the basic market, both in new installation and in replacement.

Comparative Costs

For rough estimating purposes, on a cost per foot-candle per year basis, comparative cost percentages in these pages include installation, owning, operating and depreciation, cost of current and lamp replacement, etc., for a ten-year period. Fluorescent is used as the base of 100%, an 8-ft. industrial RLM unit with four 40-watt 3,500° white F lamps.

DATA

Bulb Types

A-standard; G-round; S-Straight side; P-and PS-pear shaped; T-tubular; F-flame shaped; C-cone; R-reflector; PAR-projector.

Bulb Finishes

Clear, inside frosted, white bowl, daylight, color-outside coated, inside coated and natural colored glass, silver bowl, silver necked.

Filament Forms

There are 20 or more forms, a few of which are designated for burning base up or base down, but the majority in any position. (Consult catalogues.) Filament is either S-straight, C-coiled, or CC-coiled coil.

Gas Filled

Most lamps of 40 watts and above are gas filled to permit higher temperature and higher efficiency.

Bases

Range from candelabra, through intermediate, medium and mogul in screw bases, with 3-lite and admedium (for mercury), medium prefocus and mogul prefocus for special types. Also medium bi-post and mogul bi-post for special lamps. Disc type used on tubular lumiline. Bayonet type on miniature lamps only, generally.

Wattages

6, 7½, 10, 25, 40, 60, 100, 150, 200, 300, 500, 1,000, 1,500, 2,000 in standard types.

Life

1,000 hours except 25, 100 CC, 150, 200 and 300 which are 750 hours; 6, 7½ and 10, 1,500 hours. Projectors shorter life.

Lumens per Watt

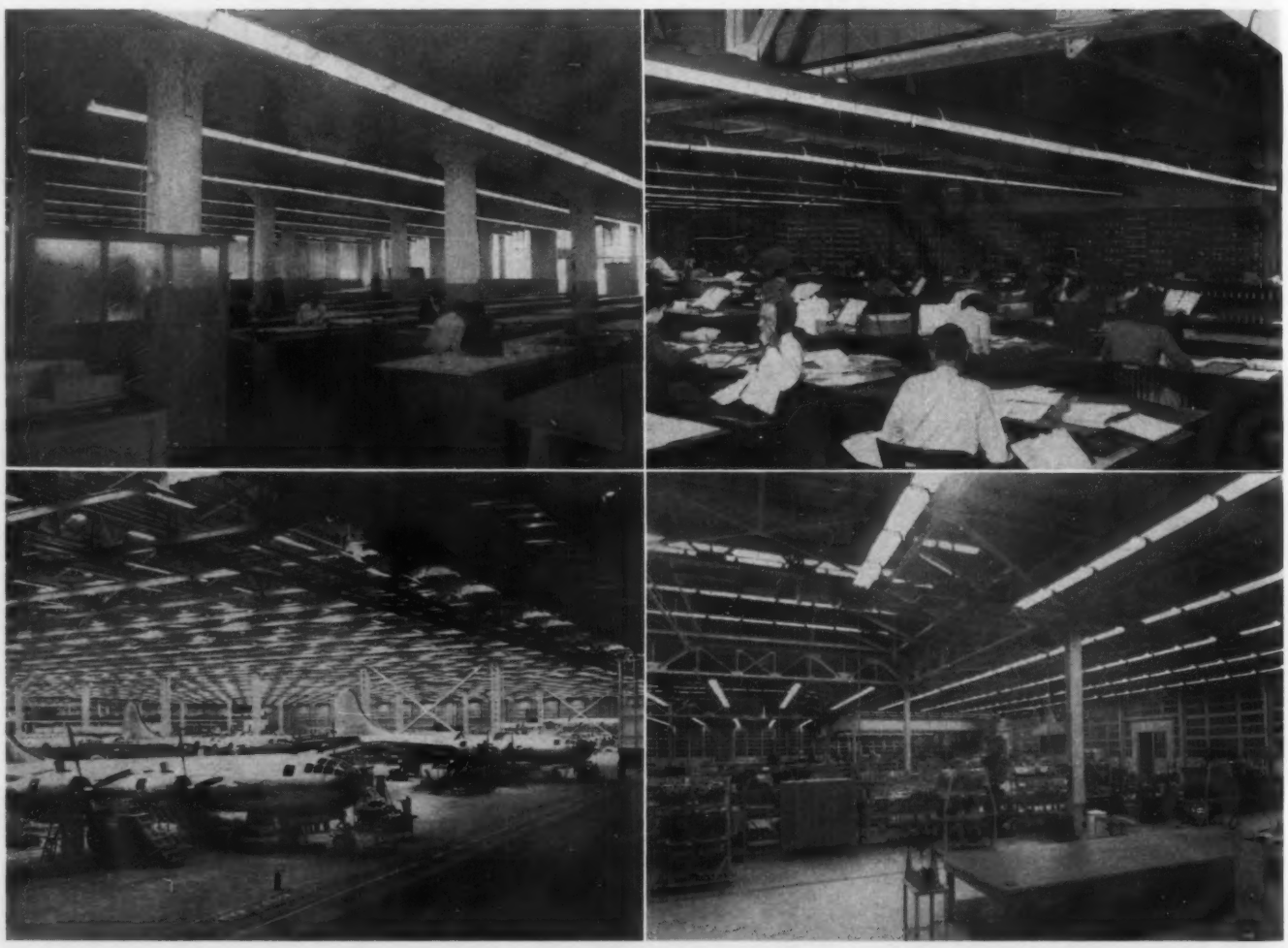
Ranges from 6.6 for 6 volt, to 21 for 1,000 watt; average 15 in range of 60 to 100 watt sizes.

Cost

Using porcelain enameled reflector and 500-watt silver bowl lamp, total cost 163% of standard fluorescent although initial installation cost only about 40% of above at present prices.

FLUORESCENT

Above, Vega Aircraft turns out a river of B-17 bombers under a sea of fluorescent units at Burbank. Below, left to right, top row, drafting room of a Los Angeles aircraft plant and of the accounting department, North American Aviation, Inglewood, Sylvania lighted. Below, combined fluorescent and mercury high-intensity lighting in Boeing's B-29 Superfortress plant at Renton, Wash. and engine repair building at Army Air depot at Galena, near Spokane, with 621 F units



FLUORESCENT

Since introduced at the San Francisco and New York World Fairs in 1939, fluorescent lighting has progressed speedily and threatens to assume the major place in general illumination. Given further impetus by the war's industrial uses, manufacture is on the mass scale and costs relatively low. Herein are some of the factors to consider in choosing it as a light source in competition with other available sources today or soon to be available

LIGHT SOURCE SELECTION GUIDE

Characteristics

Standard fluorescent, or hot cathode, is a linear source, coming in standard lengths or sizes for given steps of wattage, in standardized colors and three types of "white," of measured color-temperature ratings. The lamps are tubular, have relatively low-surface brightness (from 3 to 5 candlepower per sq. in.), longer life than incandescent lamps and are easily replaced.

Advantages

Because of higher lumen output per watt, more illumination and less heat is obtained from fluorescent lamps than from incandescent. The surface brightness is lower, the diffusion of light better. A linear source lends itself better to many architectural treatments. Longer lamp life and lower current consumption for a given light output make for long-time economy. F lamps operate in any position. Often more illumination can be obtained from old wiring by a change to fluorescent.

Disadvantages

For accurate beam control the tubular lamp is not desirable. If operated with single-lamp ballast, there may be stroboscopic effect as well as low power factor. Color may not please some because of a low content of red shades in the light from "3,500° white," or too much from "soft white." Where voltage fluctuates severely lamps may go out. The type with starters takes a moment to start. Fluorescent is difficult to start and operates poorly at extremely low temperatures. Requires auxiliary equipment—ballasts, starters, condensers, all of which complicate maintenance and increase weight and bulk of installation.

Control of Light

Fluorescent fixtures may be selected which have high efficiency reflecting surfaces, such as porcelain or baked enamel, alzac aluminum or chrome on steel. For most applications it is desirable to use fixtures with proper shielding by means of louvers or glass or plastic covers to reduce brightness to the eye.

Availability

Fluorescent lamps are manufactured by practically all lamp companies, and distribution of replacement lamps is such that lamps are readily available at low cost almost everywhere. Starters and ballasts are likewise readily available in peacetime, and the manufacturers of fixtures are legion. Certified fixtures, therefore, are a protection to the user.

Future

With return of peace, the range of colors, the quality, and simplification of equipment can be expected to improve. Wartime lighting levels made possible by use of fluorescent will doubtless be carried over into civilian uses.

DATA

Types

Standard fluorescent (F), starterless, and RF, or rectified fluorescent (see mercury, page 59).

Wattage

Miniature lamps of 6 and 8 watts. Medium base lamps of 14, 15 (T-8 and T-12), 20, 30 and 40 watts. Mogul lamps 65, 100.

Tube Sizes

6w.-T-5, 5/8". 8w.-T-5, 5/8". 14w.-T-12, 1½". 15w.-T-8, 1". 15w.-T-12, 1½". 20w.-T-12, 1½". 30w.-T-8, 1". 40w.-T-12, 1½". 65w.-T-17, 2⅛". 100w.-T-17, 2⅛". Starterless—40w. size only.

Promised circular — 20w.-1¼". 30w.-1¼". 40w.-1½".

Tube Length

Includes tube and two sockets: 6w.-9". 8w.-12". 14w.-15". 15w.-18". 20w.-24". 30w.-36". 40w.-48". 65w.-36" 100w.-60". Circular, outside diameter of ring, 20w.-8½". 30w.-12¼". 40w.-16".

Colors

Daylight and 3,500° white in all wattages. Soft white, blue, green, pink, gold and red in 14-, 15-, 20-, 30-w. sizes (after the war).

Circuit Voltage

For all sizes 110-125-v. For 30-, 40-, 65- and 100-w. sizes, ballasts for operating at ranges of 199-216v., 220-250v. and 254-280v. can be had. Starterless requires special ballast to provide 450v.

Lamp Life

6 and 8w., 750 hr. 14w. 1,500 hr. 15-, 20-, 30- and 40w. 2,500 hr. 65w. and 100w. 2,000 hr. Starterless 1,500 hr.

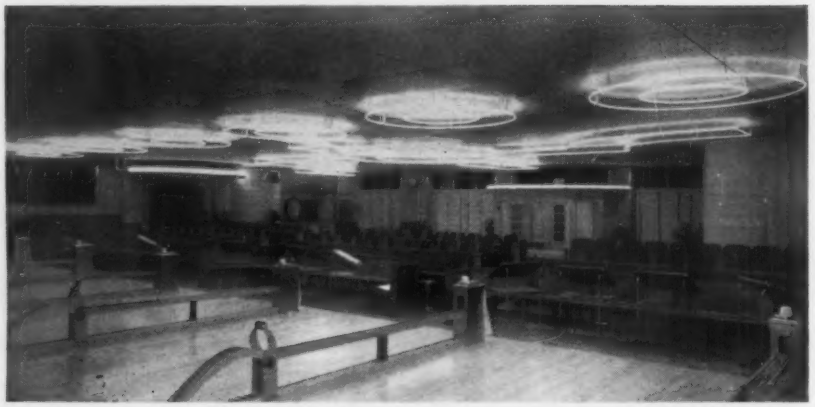
Efficiency

Including the ballast fluorescent lamps produce approximately two to two-and-a-half times as much light per watt as incandescent.

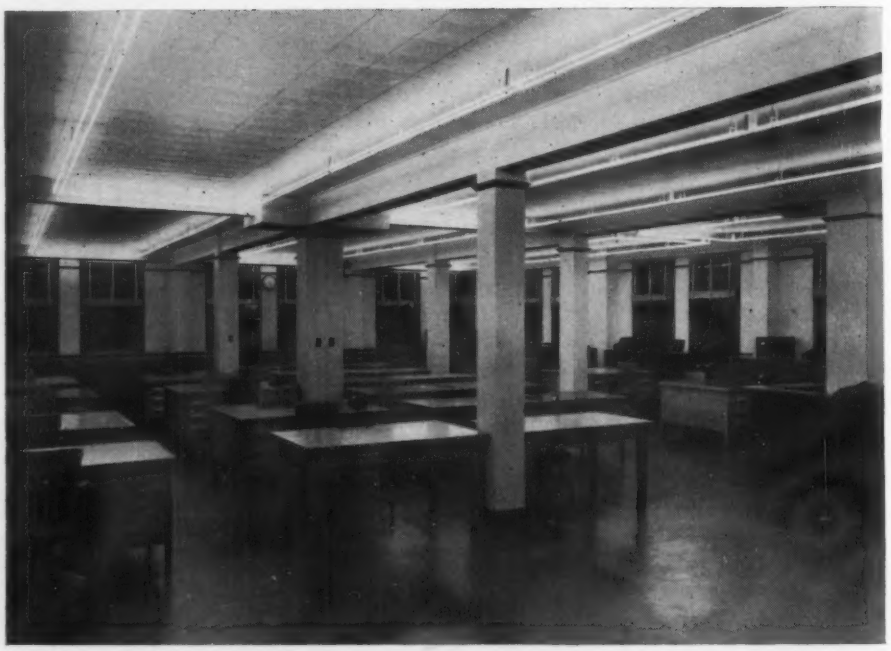
Relative Cost

Based on 8-ft., industrial RLM unit with four 40-watt F lamps—100%. Starterless installation—111%.

COLD CATHODE



It is all fluorescent lighting, whether hot or cold cathode, and many wish that no differentiation be made between them. The term cold cathode, however, has been commonly applied to the type of fluorescent lighting that came indoors from the outdoor electric sign. At first all of its indoor applications were custom-made jobs such as these pioneers illustrated on this page. After the war, there will become available standard package units with standard lengths of tube and known performance data and quality. Pictured above is a bowling alley in Denver, showing decorative treatment possible with this source



Above, one of the first office interiors lighted with cold cathode tubing, that of Standard Oil Co. of California, in Seattle. This pioneered many similar installations and since then the idea has spread. At the left is the first industrial lighting job with tubular lighting of this type. It is at the Webster Brinkley machine shop, in Seattle. All of the installations illustrated here were made by Electrical Products Consolidated, which made the first major indoor invasion with its tubular light source to furnish an ample foot-candle intensity

COLD CATHODE

Newest contender in the light source field, it has grown from its beginnings in the sign and outdoor decoration applications to demand a place inside for commercial, industrial and perhaps even domestic lighting. Now packaged in replaceable units, it bids to compete with standard fluorescent and incandescent where they previously held the field alone. Its ace card is that custom-made tubing can fit any pattern

LIGHT SOURCE SELECTION GUIDE

Characteristics

Tubing, coated with fluorescent powders, which can either be run in straight lines or bent to swirl, curve, circle or turn sharply at any angle to fit the architectural pattern. Tubing may be any of several commercial sizes and in white or a wide variety of colors. Tubing is sometimes installed directly on ceiling or can now be had in standard commercial lengths to fit a range of fixtures.

Advantages

Life of from four to ten times that of fluorescent (hot cathode) lamps. Instant starting without starters. Operates at any temperature of surrounding air, has low flicker point and no noticeable stroboscopic effect. Capable of some dimming; does not go out on voltage fluctuations. Tubing can be operated at low surface brightness, minimizing need of shielding, or high brightness for special dramatic effect, depending on current. Wide range of colors available. No appreciable darkening of tubes. Transformer is only auxiliary required (should be power factor corrected). Low maintenance cost. Especially adapted for use where replacement of lamps is difficult or interferes with production or traffic. Many commercial customers will want it because of its streamlined appearance, and because it *can* be seen.

Disadvantages

Up to now specific values and standard quality could not be found among the many manufacturers, but this is being improved by the Fluorescent Lighting Assn. Higher cost is a present disadvantage which volume may alter in the future. Bare tubing unshielded may be too bright in contrast to surroundings and create glare. Operating at high voltage presents certain dangers which inspectors may require heavily safeguarded, especially in domestic installations. Use of highest voltage makes for noise.

Control of Light

Fixtures for use with standard lengths of tubing are similar in reflector design and louvers to those used for fluorescent lamps except in longer units. Many installations may use ceiling painted with high reflection factor paint as reflector.

Availability

Standard lengths of straight white tubing will probably be made and marketed by all of the major lamp companies and by a number of large sign companies equipped to do so. The custom-made job will be available from sign companies experienced in fabricating and installing neon and cold cathode tubing on signs and for outline decoration.

Future

A strong sales effort can be expected from the cold cathode industry to enter the interior lighting field. Although costing a little more, it may well be selected by many customers because of its newness and spectacular possibilities. For special architectural and decorative effects, it will have no rival. It is definitely an important addition to the light sources available.

DATA

Types

Custom-made to fit a particular design or pattern, and standard length for commercial and industrial installation.

Tube Sizes

In common use, 12, 15, 18, 20 and 25 millimeter outside diameter. Standard lengths will be 5 ft. 6 in. in 12-, 15-, 18- and 25-mm. tube; 7 ft. 9 in. in 18-mm. tube, for use with 6-ft. and 8-ft. fixtures respectively.

Colors

Standard cold cathode "warm white" is about equivalent to hot cathode fluorescent 3,500° white. By various combinations of gas, fluorescent powders, color of glass tubing and pressures, a wide variety of shades and colors can be produced in custom-made.

Brightness

Both brightness of tube in ft.-candles per sq.in. and lumen output depend on six variables: 1. milliampere flow of current, 2. diameter of tubing, 3. pumping pressure, 4. purity and color of glass used, 5. quality of fluorescent powders and of the coating process, 6. temperature of operation. Age, likewise, is a factor, the rate of depreciation being about 17% at the end of 2,000 hr. burning, 27% at the end of 10,000 hr.

Transformers

Number of transformers and secondary open-circuit voltage to use depends on results wanted. Transformers from 3,000 v. to 15,000 v. are available. Lower voltage gives less noise level, requires less rigorous insulation, is smaller in bulk. Higher voltage transformers give higher efficiency, more footage per transformer and require less wiring. Maximum loading would be 12 7-ft. 9-in. tubes on a 12,000-volt, 120-ma., short-circuit voltage transformer, which would consume 629 watts, and give about 266 lumens per watt.

Cost

Using as base an industrial fixture, with two 7-ft. 9-in. tubes, 8,000 hr. life; 100 to 120 ma. operation, cost as compared to standard fluorescent over 10-year period would be 132%.

MERCURY

Moffett Field blimp hangar (cover also) lighted by 42 Westinghouse 3-kw. mercury A-H9 units, is 1,000 ft. long, 300 wide, 175 high. Lamps are 133 ft. above floor, 95 ft. apart, 52 ft. between centers of two rows

Extra light for slab inspection at Geneva Steel plant in Utah furnished by two rows of 3-kw. A-H9 mercury lamps in open-end porcelain enameled reflectors, 30 in all, mounted 42 ft. above the floor. Rows are 28 ft. apart, units spaced 25 ft. apart. The Westinghouse Millite fixtures used for general lighting in the entire plate mill, equipped with 1,000-watt incandescent lamps, give color correction. Intensity 50 f-c.

First installation of 3-kw. mercury in the West was made by General Electric at Douglas Aircraft, Santa Monica, where lighting was like that at left before relighting. Then the lighting was from 92 high-bay reflectors, 72 of them 1,000-watt, 20, 750-watt, spaced 29½x29½ ft. centers, mounted in rows 30, 50, 67 and 76 ft. above floor because of curved roof. After relighting, there were 50 3-kw. A-H9 lamps in porcelain enameled reflectors and 20 750-watt incandescent units. Spacing was 35x35 ft. at the same mounting heights stated above. Lighting level before relighting was about 9 f-c. after relighting and burning, an average of 38½ f-c. from an initial 50 f-c. Additional units installed for supplemental lighting on jigs and in the cabins consisted of 140 two-lamp, 40-watt F lamp fixtures and 60 two-lamp 20-watt fixtures to supply from 10 to 50 f-c. of local lighting. The job was engineered by John Murray, electrical engineer, Douglas Aircraft, assisted by H. J. Chanon, district engineer, Lamp Department, G-E, Los Angeles, the first of its kind

MERCURY VAPOR

For higher intensities per watt, the mercury-vapor lamps have long been the most economical producer, from the first Cooper-Hewitt lamps to the latest 3,000-watt lamp. Only the blue-green color was against this source. But for many applications, the color had its advantages and in others it could be supplemented with incandescent, rich in red and yellow, to give a more balanced spectrum of blended lighting

LIGHT SOURCE SELECTION GUIDE

Characteristics

All mercury-vapor lamps are arc lamps operating in an atmosphere of mercury vapor, giving off an almost monochromatic light in the blue and green bands. Higher intensity can be generated in a given space with this source. (Sodium-vapor lamps are similar but the color emission is all in the yellow band.)

Advantages

Long life and high foot-candle per watt output. The Cooper-Hewitt type has now been given a glass tubing to which fluorescent powders have been added, giving a better color range. The high-intensity lamps give more light per unit and hence are useful for extremely high-bay mounting and for street lighting. Because the eyes are most sensitive in the green range, the light is often used where critical inspection is to be done.

Disadvantages

Color of light is the chief objection to its widespread use. It requires auxiliary equipment; for the extremely high intensity, a water cooling system as well. Cost of equipment, originally is relatively high but operating cost is low. There is a delayed start and, when lamp is extinguished, it takes a while to restart.

Control of light

The linear mercury lamps, such as Cooper-Hewitt, RF and the new 3,000-watt, may be employed in reflectors similar to those used for fluorescent. The high-intensity lamps are used with prismatic glass or metal bowl reflectors or with street-lighting refractor lens units, much the same as those for incandescent lamps. When not mounted high, means should be taken to shield the extremely bright light source from direct view.

Availability

Made by the major lamp companies only, these sources are obtainable through electrical supply houses handling industrial electrical equipment as a general rule. Since most installations should be engineered, the advice of illuminating engineers is recommended.

Future

The war has given impetus to use of mercury-vapor lamps in many large industries, chiefly aircraft and steel, where large areas are lighted from high mountings. Combined with incandescent, the mercury source promises to be more widely used. For street lighting, both the mercury and sodium will find extensive use. In street lighting, the mercury color is not unlike moonlight and its high efficiency provides more adequate street illumination for the same money. The sodium light is being used as warning of danger, at heavy traffic intersections, approaches to highway underpasses and bridges and similar hazardous places.

DATA

Types

Cooper-Hewitt and RF, or rectified fluorescent, (a Cooper-Hewitt with a fluorescent-coated tube); in three lengths, 50, 33, 22 in.; 400-watt H1; 250-watt H2; 1,000-watt H6, water-cooled (capillary); 250-watt H5; 100-watt A-H4 standard bulb. (For sunlamps see Ultraviolet page 63.)
Sodium 10,000 lumen, 180-watt; and 6,000 lumen, 145-watt.

Auxiliaries

Transformers have been designed for operation with each type and should be used with such lamps to derive best performance. Power factor corrected transformers are to be preferred for maximum use of the wiring system. Without correction, power factor is about 50%. Wattage of auxiliaries should be added to lamp wattage in computing wiring capacity. Auxiliaries may be mounted on fixture or, to save weight, away from it.

Lamp Life

H1, 3,000 hr.; H2, 2,000; H4, 1,000; H5, 1,000; H6, 75 hr. Sodium, 3,000 hr. Cooper-Hewitt and RF, 3,000 hr.

Efficiency

Lumens per watt for lamps—H1, 40; H2, 30; H4, 34; H5, 40; H6, 65. Sodium, 50. Cooper-Hewitt, 19.4; RF, 50.

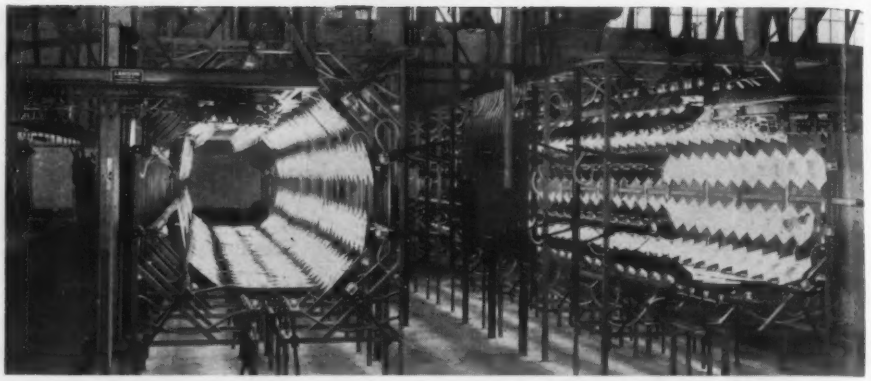
Starting time

The H1, H2, H4, H5 and sodium lamps take from 3 to 7 min. from starting to reach full output and, if extinguished, to relight. The H6 takes but 2 sec. and Cooper-Hewitt and RF start in two or three seconds.

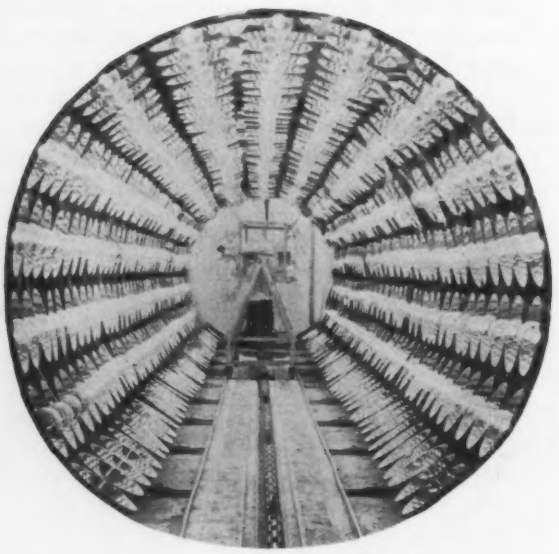
Bases

Mogul bases are used on H1 and H5, medium on H2 and admedium on H4, which is adapted as BH4 for ultraviolet, CH4 for spotlight, EH4 for floodlight, both the latter having PAR-38 bulbs.

INFRA-RED

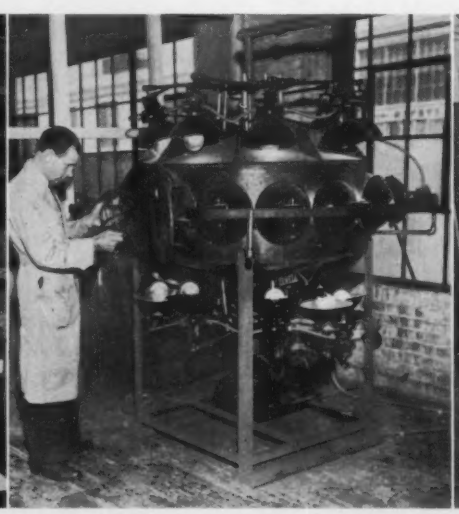


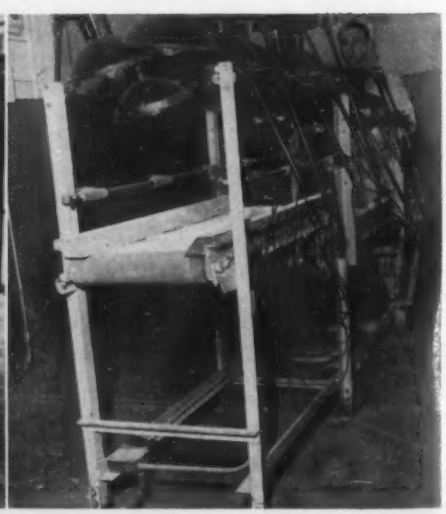
Two 32-ft. Fostoria tunnels in which enameled engine parts are dried and baked in 10 min. at San Bernardino Air Service Command engine repair shop



Above, engine parts on conveyor at San Bernardino shop. At right the largest tunnel of infrared in the West, 675 Fostoria reflectors and 250-watt carbon lamps, and a new idea in Lamson conveyors suggested by Bill Wuelker of Leo J. Meyberg Co., a dolly on which all related parts are suspended and drawn through at once, aiding reassembly

Below, illustrations of small but effective applications of infrared. Left, Bradley Mfg. Co. to dry thick lacquer on engraving plates. Center, small tunnel to dry hard hats for construction workers made by E. D. Bullard Co. At right, drying ingredients for pills, capsules and pellets at Permanente Hospital Foundation in Oakland





INFRA-RED

Always a source of more heat than light, the incandescent lamp is now being especially designed to operate less as a lamp than a heat source and is finding wide application in the field of drying and controlled heat application. The control accuracy possible with a concentrated source in light is likewise possible in control of heat distribution from a similar point source. Extension of these uses offers opportunity in the future

LIGHT SOURCE SELECTION GUIDE

Characteristics

A filament lamp, so designed as to reach only a glowing red color, rich in red and infrared radiation, which is in the heat range, is a convenient, packaged heat source. The beam can be controlled and directed where desired to do a heating task quickly.

Advantages

Heat can be applied to a given object or area without the necessity to construct a large oven. The heat is instantaneous, turned on when wanted, off immediately when not wanted. There is no long warming up or cooling off period. The radiant heat penetrates surfaces quickly. For drying paints or finishes, the heat penetrates the liquid and heats the object, which in reflection or reradiation assists in the driving off of moisture content of the paint or finishing compound. Time saved over oven methods is very material in most cases. Economy comes from shortened time, increased output, lower first cost in equipment in most cases. Flexibility is great, and accurate spotlighting of the heat, if desired, can be accomplished.

Disadvantages

The method is not universally applicable. It does not work as well where a deep penetration of heat is required nor on surfaces or finishes which reflect the infrared rays instead of absorbing them.

Control of rays

Two types of lamps are available. The clear bulb lamps are used most efficiently with gold-plated reflectors designed to give the required pattern of distribution, either in a diffuse flood pattern or concentrated beam. The reflector type of lamp is equipped with its own reflection surface inside the bulb, either silver or gold plated.

Availability

Several lamp companies make the heat lamps, either with carbon or tungsten filament, and some make the reflector type of lamp. There are at least two manufacturers of gold-plated infrared reflectors. Aluminum reflectors are also used. Such lamps and equipment are available from electrical supply companies.

Future

The field of applications for infrared drying and heating seems to be expanding every day as the method is tried with different materials and on different problems. Experimental laboratories are maintained to try new applications and to determine the feasibility of infrared to them. This field promises to expand greatly in the era of peacetime production.

DATA

Types

Clear glass lamps of either carbon or tungsten filament are made in standard shapes in 125-, 250-, 375-, 500- and 1,000-watt sizes. Tubular lamps of 250 watts are also made. Reflector lamps are made in the 250-watt size.

Heat

The full heat output of the lamp can be rated as the b.t.u. output of the kilowatt-hours consumed by the lamp. Thus a given heat lamp can be counted to dissipate 3,414 b.t.u. per kwh. With efficient reflection equipment, nearly all of this will be directed to the product being heated. Calculations, however, should be made of the material to be heated, efficiency of the total lamp bank, absorption by the work. Then, by means of charts, the total kilowatts required can be determined. Efficiency of a reflector and lamp bank will run from 50 to 80%, depending on the arrangement of units, surrounding the oven with a shield, or other means of confining the heat.

Bases

Base for lamps up to 250 watt, clear and reflector, are of the skirted medium-base type. 500- and 1,000-watt lamps have bi-post base. Sockets for use with these lamps should be of heat-resisting type.

U-V Speeds Penicillin Growth

Samuel H. Hazleton, Jr.
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General Electric Lamp Dept.
Oakland, Calif.

GERMICIDAL lamps have moved definitely up out of the experimental class into a definite field of special use under the stimulus of war production. Perhaps one of the most significant applications of such lamps is that to be found in the new $750,000 penicillin plant now operating in Berkeley, Calif., for Cutter Laboratories, one of the country's largest manufacturers and processors of blood plasma, albumin, vaccines, antitoxins, etc.

Here the germicidal lamps are specifically used in the inoculating room to provide an absolutely sterile atmosphere at a critical point in the production line for the making of penicillin.

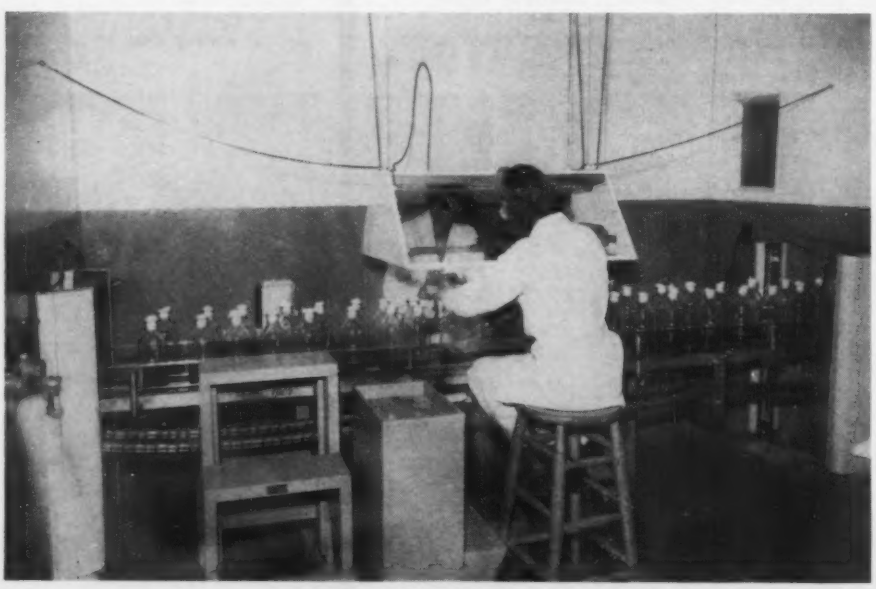
Penicillin, it will be recalled, is a recently developed and potent bacteria arrestor or killer, practically the entire production of which is now used by the armed forces for sterilization of wounds and bacteria control. As produced at Cutter Laboratories, penicillin is under the auspices of the committee on medical research of the Office of Scientific Research and Development, National Research Council, and the Department of Agriculture.

The function of the sterilizing and germicidal lamps at the Cutter plant is best illustrated by a brief description of the process. In this plant the bottles are washed carefully, sterilized and dried in automatic equipment and mechanically filled with an exact predetermined amount of a corn-steeping liquor. Each bottle is plugged with cotton batting to keep bacteria out but to allow access of air to the liquor. Filled bottles pass directly from the filler into sterilizers and then are placed on a conveyor which leads into and through the completely sterile inoculating room where the mold spores are introduced.

As each bottle, via the conveyor, moves through the entrance portal to the room, it passes through two asymmetric type, polished aluminum, Tru-Ad 30-watt germicidal lamp fixtures. Here the bottles are irradiated with the ultraviolet wave length. Likewise, these lamps provide an excellent bacteria-killing screen to cover the room entrance opening. The room dimensions are 10x10 with a ceiling height of 9 ft. Ceiling and upper walls are of a white color with a light reflection factor of approximately 70 to 75%.

It takes a bottle approximately ten seconds for its passage through this room. Two girls work on opposite sides of the conveyor. They remove the cotton batting stopper from the bottles as they appear on the conveyor line, insert the mold spore, and replace the stopper. They operate immediately alongside a Tru-Ad 30-watt germicidal, glass-enclosed, hood type fixture over the conveyor belt. The glass sides of this unit protect the girls' eyes. Each girl also wears side-enclosed goggles.

Germicidal lamps are on each side of conveyor entrances and under hood fixture



As the bottles exit from the room, they again pass between another pair of upright germicidal fixtures of the same type as those used at the entrance. It has been necessary to select employees with low skin sensitivity to germicidal ultraviolet radiation, because some of the direct radiation from the upright entrance and exit lamps reaches the sides of their faces. Although this is a small amount, in the case of girls with sensitive skin, reddening has been experienced.

Hands of the girls that work underneath the center germicidal hood are covered with rubber gloves. Such precautions indicate those necessary for individuals working with and around bactericidal ultraviolet radiation.

Before installation of the germicidal lamps, it was necessary to use a Bunsen type of flame to burn the tops of the bottles and of the stoppers for sterilization. This took just about twice the time. With sterilization by the lamps, those in charge feel there is 100% freedom from bacterial contamination during the process. From a production standpoint, experience at the laboratory indicates that as good a job of sterilization is done as with the Bunsen flame in one-half the time.

Tests made of the ultraviolet bactericidal energy radiation in the 2,537 Angstrom unit range by means of the Luckiesh-Taylor germicidal adapter and a standard General Electric light meter, measured in watts per square foot, indicate a horizontal range from .05 at the entrances to a maximum of .40 under the fixture where the spore is introduced, and a vertical of .75 down to .075 in the center, all readings being relative to the distance from the light source.

Penicillin, it is explained, is formed during the period when mold is forming. It is secreted by *Penicillin Notatum* as it draws its food from the culture liquid. Presence of any contamination during that period, or carried over from the inoculation period, would result in the loss of a bottle so contaminated. Germicidal lamps, therefore, are depended upon as a positive means to guarantee success of the culture during a critical point in its process. With such exact requirements under observation and tests, application of this germicidal lamp to other processes requiring similar degrees of sterilization can be predicated.

ULTRA-VIOLET

At the high end of the spectrum are the ultraviolet sources of light with special fields of application. The near ultraviolet provides artificial sunshine or activates fluorescent paints, dyes, oils or plastics to produce spectacular effects. Higher ultraviolet is lethal to airborne bacteria and is finding increasing uses in the field of sterilization. Still higher ultraviolet uses are beginning to emerge for activating and fluorescing other materials

LIGHT SOURCE SELECTION GUIDE

Germicidal lamps

Touching upon the cautious field of medicine, germicidal and sterilizing lamps have had to await test and experience before getting endorsement for a more expanded use. The preliminary stages seem to have been passed and these lamps, where carefully measured wave lengths and proper precautions are adhered to, will find increasing applications. Located in air ducts or installed in fixtures which permit none of the rays to reach humans directly, in offices, schools or factories, they reduce air borne bacteria and inhibit the spread of colds and other contagions. Installed in food processing plants and refrigerators, they retard the growth of molds and spores which spoil foods. Applied over dishes or glassware, they assist to render them sterile.

Sunlamps

Although the Federal Trade Commission prohibits almost all claims of benefit in advertising of sunlamps, their use for several years has undoubtedly proved beneficial. Some skins and some skin afflictions are harmed by their rays as they are by those of the sun, but most people can obtain synthetic doses of sunshine by judicious use of sunlamps. The convenience of being able to turn on the sun at one's own convenience, and no matter what the season, weather or time of day, is a chief advantage. Sunlamps should be used with timers for safety wherever possible.

Ultraviolet sources

In the field of spectacular lighting, ultraviolet has a long history of use. By means of costumes, cosmetics, paints and materials that fluoresce with an activation by ultraviolet, brilliant color effects and radical transformations can be wrought. A scene painted in visible colors can be completely changed under ultraviolet light, where special paints which fluoresce are used for a different design. Of recent years, ultraviolet light has been used in crime detection, detective work and in the analysis of documents, paintings or other works, for signs of tampering, alteration or fingerprints. Theaters and dance halls have used an invisible stamp of pigment on the hand as a pass-out check, the ultraviolet light revealing it upon re-entry. Advertising posters with fluorescent inks have been developed to bring the brilliant color effects, possible only with activated fluorescent pigments, to the display field. Aircraft instrument panels in blacked-out night fighters have been made discernible by faint ultraviolet irradiation. The field of application of such light sources is in its beginnings and will be expanded with exercise of imagination and ingenuity.

Glow lamps

Only because the light produced in them is by the same discharge process employed in ultraviolet are glow lamps to be classified in with the ultraviolet sources. Their application is in long-burning pilot lamps, night lamps, house numbers, instrument panels. A number of decorative ornaments employing their method have also been developed. The smaller sizes are used for test lamps to detect the presence of current, indicate whether it is direct-current or alternating.

DATA

Germicidal

Each manufacturer has different specifications and lamp sizes, wattages, terminals or bases. Leaders are Westinghouse "Sterilamp," General Electric "Uviarc," Sperti, Inc., Hanovia Chemical & Mfg. Co. Data should be obtainable from these.

Sunlamps

While again many manufacturers have special lamps, the Mazda companies have standardized on S1, S2 and S4. S1, 400 watts, 500 with auxiliary, 400-hr. life, mogul base, IF bulb has ultraviolet output of 68,000 E-vitons, takes 5 min. to reach full output. S2, 130 watts, 175 with auxiliary, 300-hr. life, medium base, has output of 8,000 E-vitons, takes 8 min. to reach full output. S4 is the same as mercury A-H4, except in a sunlamp bulb, clear; is lamp of 100 watts, 120 with auxiliary, 1,000-hr. life, and has an output of 68,000 E-vitons. Takes 3 min. to reach full output.

U-V producers

For production of ultraviolet for spectacular effects or for detection, sources rich in ultraviolet are: B-H-4 mercury lamp, or capillary type, with red-purple bulb is most efficient (see data on H-4 lamps). The CX lamp, with special bulb to eliminate visible light, requires no auxiliary, but is weaker in u-v output. Still weaker but useful for small amounts is the argon-filled glow lamp S-14, 2½-watt. Ballast is located in the base.

Glow Lamps

Not ultraviolet but of the vapor type are the small glow lamps, S-14 3 watt; S-14 2 watt; G10 1 watt; T-4½ ½ watt, each containing its ballast in the base, and T-2 1/25 watt, requiring external ballast. These are chiefly used for signal and pilot lamps.

Contrast between the unshielded and shielded portions of the bridge approach and the totally shielded portion

LESSONS FROM THE DIMOUT

Fred J. Wellhouse*

Street and Highway Lighting Engineer
Westinghouse Electric & Mfg. Co.
San Francisco

MANY of the lessons learned from the dimming of lights along our coasts for protection of shipping and cities from enemy attack will be of military value, useful if such an emergency should return. However, war experiences often teach us valuable lessons for peacetime use.

A lot of people were killed and many more were injured due to the reduced visibility during the dimout. It was simply a case of modern travel speeds being too high for the curtailed lighting. If the horse and buggy days had still been here during this period, many of those dead would still be alive. The sad experience has brought a new realization of the necessity for matching speed with proper lighting.

An analysis of the accidents and deaths shows that the *dimmer the lights the greater the human toll.* Along the shore line where traffic was heavy, where auto headlights were dimmed and there were no street or highway lights, the loss of life was heaviest. In the urban areas visible to the sea where street lights were masked both from the sky and from the sea, the human loss was greater than in those areas where the light was masked only from the sky. On the Atlantic Coast where the shielding was more severe than on this coast, the rate of accidents was even higher.

We have thus learned from our sad experience that today's means of travel, with its accompanying speeds, requires proper illumination for safety. We cannot make the motorist slow down to speeds for safe visibility to match the variable lighting conditions that exist from place to place because he does not realize the danger until too late. Neither does the pedestrian realize the hazards he faces without proper street lighting.

Those who have lived in the dimout areas *now know* the safety of light. This knowledge seems to be spreading, because at the present time rumblings are heard from several sources that the public is becoming light conscious and beginning to demand that governmental authorities provide them with safe lighting.

If this important lesson has been learned, it may serve to save many lives in the future and those unfortunate victims may not have died in vain. When municipal authorities are ready to spend at least $2 per capita per year for this type of safety for their citizens, one dimout result not contemplated by the military will have been achieved.

Another lesson, more pleasant to be sure, has been learned from the shielding of bright street lights so that the glare from the electric lamp is not annoying and not a hindrance to vision. Many of the shields used during the dimout reduced the downward light very little and, at the same time, eliminated the blinding glare in the motorist's eyes. It was found that, although the light along the street was not so even, the elimination of the glare made seeing easier.

It has long been known by lighting engineers that the glare from street lights reduced visibility in the order of 25 to 30% from what it would be without that glare, but it was thought necessary to endure the glare to get the light out to the spaces between the units. The dimout has taught us that the reverse is to be preferred.

An outstanding example of this has been accomplished by the California State Highway Division on the San Francisco-Oakland Bay Bridge. Although the shielding was required as a military precaution and the shields were constructed with a view only to reduce the upward light and not to make an efficient reflector, the results were found to improve the visibility and make more comfortable lighting by the elimination of the glare from the sodium lamps.

Many other instances were found where the shielding has reduced the glare and improved the visibility. This lesson has already created a demand for luminaires with shielded light sources which may set the pace for an important advance in street lighting. Developments of this kind are already under way for the time when materials are no longer required exclusively for war purposes.

* Mr. Wellhouse recently returned to Westinghouse from a leave of absence with the U. S. Office of Civilian Defense, where he served as Chief of the Light Control Section, Pacific Coast Region.

STREET LIGHTING FOR SAFETY

H. T. Rankin
Lighting Department Superintendent
Public Service Co. of Colorado

THE theory of the principal function of street lighting has undergone a radical change in the minds of the municipal officials in most metropolitan cities. The practice of "White Way" lighting on a few streets at the expense of all other streets has given way to a practical approach to the problem of reducing the number of avoidable night traffic accidents by applying artificial illumination to the maximum number of traffic arteries in the most economical and efficient method consistent with good engineering.

Denver city officials were among the first to recognize the seriousness of the growing traffic problem. Traffic records supported the contentions of their constituents that the most prevalent excuse was "I couldn't see."

George E. Cranmer, manager of parks and improvements for the City and County of Denver, was requested to do something about the street lighting problem in Denver without increasing the street lighting appropriation. Cranmer presented his problem to representatives of the Public Service Co. of Colorado who were also vitally interested. Hence in 1935 we found ourselves face to face with an urgent problem requiring immediate solution.

We were requested to maintain present standards of street lighting and make certain extensions without increasing the cost of service. This, we concluded, could be accomplished in either or both of two ways. Reduce the present rates to permit extensions at the same cost and/or improve our existing street lighting systems to give more light for a specific unit cost. Investigation of the rate schedules very definitely showed that rates could not be reduced to such an extent that expansion of facilities would be possible. Therefore, it was decided to explore all the possibilities of the latter. A physical geographical examination of our street lighting equipment, combined with an engineering study of existing luminaires, mounting heights, spacings, light distribution and efficiencies, convinced us that the commonly accepted upright unit was delivering less than one half of the light to the street pavement or the object to be seen.

Exhaustive studies and elaborate demonstrations were made with each and every new type street lighting luminaire that we could secure. Visibility tests were made, foot-candle readings were taken, and over ten thousand readings were made with the Street Lighting Evaluator which had just been developed. This instrument provided the first practical method of measuring visibility on the street. The two positive elements that contribute to seeing, "Light on the Road Surface" and "Light on the Object," were balanced against the negative element, "Glare," and a resultant visibility standard was established for a particular street in terms of ability to accommodate a given number of vehicles per hour.

Because Denver holds first position in the United States for the use of mercury-vapor lighting, having approximately one-third of all the units in the nation, many other communities and utilities have asked the reason. Several groups of engineers have gone to Denver, others written to the Public Service Co. of Colorado for information about the experience there with mercury street illumination. In this article, Harold Rankin gives the reply which he makes to such inquiries for the benefit of all interested cities and utilities. Technical details of Denver's street lighting are being made the subject of a paper by Dana Rowten presented at the annual meeting of the Illuminating Engineering Society in Chicago in September and will be published in the December "Illuminating Engineering," but the philosophy, the reasoning and economics are to be found in this article on these pages.

The results of these studies were startling and provided the impetus to a new technique in street lighting, at least in this area. We were convinced that the new pendant type luminaire was superior to the conventional upright unit. We also decided on the use of the largest light source that could be accommodated in this luminaire which, of course, was the 400-watt mercury-vapor lamp, with Mazda lamps as a balance for color. The selection of a pendant luminaire and large light source made it possible and also necessary to increase the mounting height and spacing distance.

In choosing the equipment for our first modern installation we selected the street lighting standard that would afford the greatest mounting height and that could be supplied from stock. The luminaire selected was of the pendant design with one socket for the mercury-vapor lamp and two sockets for auxiliary incandescent lamps. This installation was made in 1937. The mounting height was 25 ft., the spacing 162 ft. staggered, and the total contained lumens 18,000 from one 16,000-lumen mercury-vapor lamp and two 1,000-lumen incandescent lamps.

A careful analysis of this installation, although not perfect, proved that our original assumption was correct. We found that it was possible to provide approximately four times the visibility in a given area with the new system as could be provided with the conventional type for a fixed cost. Thus, making the dollar go further, we could make the required extension.

The basic characteristics of the mercury-vapor lamp were expected to create new problems. From the public's point of view we did not know how the color would be accepted. However, we were pleased that all reports were favorable. For further experimental purposes, the incandescent lights were removed from certain sections and the straight mercury used with no unfavorable results or noticeable recognition on the part of the public. At present, we are not concerned with the color of the mercury-vapor lamp, and in many recent installations we have used only the straight mercury.

Street lighting offers an opportunity for aggressive sales efforts. The general conception of electric utility sales is the sale of power, electrical appliances, residential and commercial lighting. Street lighting is seldom regarded as a legitimate sales effort and placed on a comparable basis with other sales efforts.

Street lighting offers a virgin field for sales and load building. Besides the additional connected load and revenue obtained from these sales efforts, there will result a decided improvement in the relations between utility, municipal officials, civic organizations and the general public.

The public through its agents, the elected officials, is ready to buy illu-

Denver's streets were typical of most city streets, lighted by low mounted units and having poor light distribution. Below the same street as it appears under the mercury high-intensity street lighting system, showing even distribution and adequate see-ability without glare. Denver now has more streets lighted with mercury lamps than any in the country and will continue the change-over after the war

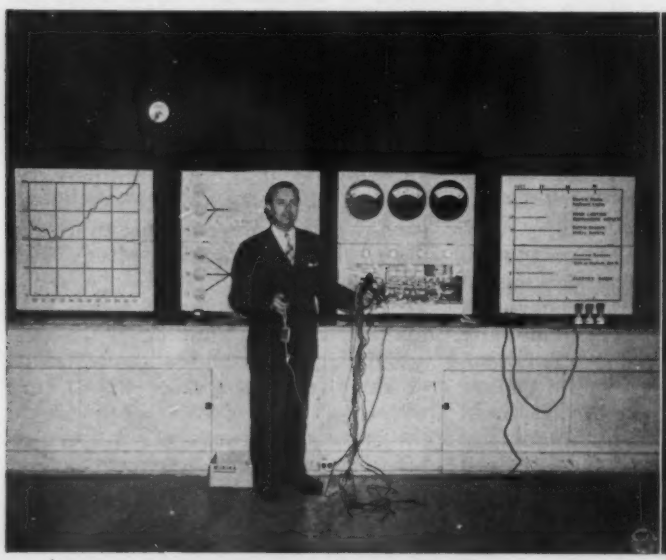
mination for its streets and public areas. It is not willing to buy lighting fixtures that do not properly meet its requirements and offer the most for the dollar. The public and its representatives are no longer mystified by electrical terminology. Given efficient equipment, scientific and practical application, and fair rates, street lighting can become one of the most profitable sales outlets of a utility.

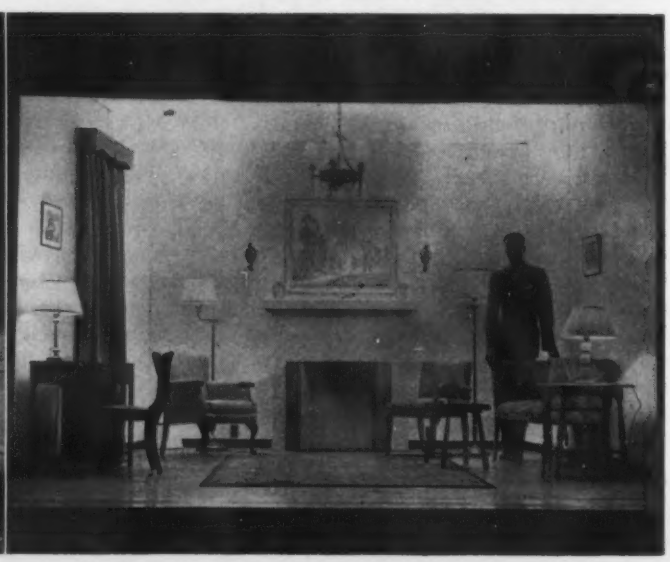
Street lighting offers the most desirable load from the standpoint of system load factor. It is possible to double or triple in a reasonably short time the present wattage assigned to street lighting with profit to the utilities and the communities they serve.

Municipal street lighting budgets have not kept pace with other municipal expenses. This is partially due to the feeling on the part of public officials that street lighting is a poor stepchild, not worthy of a place of importance in city planning. Through proper cooperation and mutual confidence, a greater proportion of the tax dollar can be used for this purpose.

An advanced street lighting plan should be scientific. It calls for surveys, analyses and calculations with specialists in city zoning, illuminating engineering, architecture, financing.

Importance of both wiring and lighting in the design of a home is dramatically presented to classes of the Home Lighting Institutes in southern California by A. B. "Doc" Smedley, left, and R. A. Buckby, right. Smedley actually shows the effects of tangled wiring. Buckby steps up home lighting from the ridiculous common to the ultimate sublime





Utilities Chart Postwar Sales Plans

Montana Power and Utah Power & Light commercial managers tell philosophy of their organizations in approaching this problem

Editor's Note — Just as every person is different, so is each man's approach to postwar planning different. Yet from surveying what others are doing and their reasons for doing so can come improvement in details and even methods. Beginning this month ELECTRICAL WEST will review briefly the postwar thinking and plans of the various utilities in the West. This information should be of interest to dealers, wholesalers, manufacturers as well as other utilities in their own thinking and planning. However, since everything is in a state of flux it can be expected that many of these plans or programs will be changed as conditions warrant such alterations or revisions.

APPROACH to the planning of postwar sales activity in Montana Power Co. was being made from a comprehensive market analysis and study of the company's relative position as against its future load-building necessities when D. J. McGonigle, commercial manager for the company, was interviewed by ELECTRICAL WEST recently. At the time of the interview, many decisions had not yet been reached, among them whether the company would merchandise or not and, if so, what lines. The pattern of the analysis, however, is interesting and shows a thorough study of some fundamental factors which will involve the company's future policies.

Fundamentally, McGonigle's philosophy is to place as much responsibility and autonomy in each of the company's division sales staffs as possible to stimulate their enterprise and to make the most of the American competitive urge. What headquarters is doing is to make the basic analysis, call for similar breakdown analyses from the divisions, compare them and, from these comparisons, develop a program for the future. This program is projected over a ten-year period during which it is desired to raise the kilowatt-hour consumption from its present 1,008 average per domestic consumer to 2,000 and likewise to increase the revenue per customer.

"We have never had the time to make as thorough an analysis before," said McGonigle. "Often I have wanted to and thought it very desirable but, with the pressure of business, there never was time to do more than a cursory analysis preparatory to a campaign. Now that we do have the time, we're making the most of it to really study our territory and its possibilities and set the findings up against the consumption and revenue goals that we must attain in the postwar period."

From headquarters the basic data are being compiled. This includes the kilowatt-hour sales by towns, the revenue per customer, both domestic and commercial. Comparisons are thereupon made with a chart recently compiled by the Ebasco companies and, likewise, comparisons are made with other Northwest power companies. Average rates are likewise checked against each other and the average revenues per customer.

Following this a breakdown is made of such figures for each division. It is further broken down by towns. By this means, it is possible to show which towns are above and which below the average.

Meanwhile, the division managers have been asked to develop their own figures and set goals for future accomplishment within the ten-year period. These estimates from divisions are then set against the total figures prepared by the company. If the goals match, they are considered satisfactory; if not, a recheck is made to see whether the division goal should be strengthened to meet the company over-all program.

By this means the divisions, having set a goal and accepted it, will have the responsibility to see that these goals are accomplished.

Another step in the study is to make a market analysis on each appliance and on lighting and other services. These will also be broken down as against each town and division.

In preliminary thinking, McGonigle's aim has been to have a minimum headquarters staff with perhaps one residential sales manager, who would also have supervision of contacts with architects, builders, and of wiring as well as appliances; an industrial and commercial specialist, who would study new trends in lighting and commercial applications, new devices, and serve as a consulting engineer; a dealer manager, who would organize the dealers and the dealer program.

As he visualized it at the time of the interview, there would be no headquarters home service director, although each division would have some home service women. In the spirit of competitive enterprise, these division women would compete in their efforts for the privilege of attending national meetings and training classes and thus be charged with the responsibility of bringing back to their fellow workers the information they obtained.

No definite dealer policy has been developed as yet. McGonigle felt this would evolve from a market analysis and a study of the classes of load wanted and those which would require special stimulus. When the entire work was done, it would be submitted to management and a definite policy would be evolved and enunciated from management. This would apply to all divisions and managers. It is to be contained in a portfolio which also will have the individual division program and plan. Thus equipped, each division will be ready to go to work the minute war is over.

Division sales organizations will be worked out largely by the divisions themselves. Since the load goals and objectives are their responsibility, they will be in better position to determine what staffs they require to accomplish their quota within the budget of sales cost. Aid from headquarters will be in direction and advice but not by prescription, McGonigle felt.

A similar program was being developed for the company's gas properties. After a thorough analysis the facts would be available from which the company could determine both its gas and electric policy and the size of the organization required to make it effective. From this the company will decide what it will sell, what the company will not sell itself but will depend entirely upon dealers to sell, where to place the emphasis, such as whether on electric ranges or gas water heating or house heating, etc.

With such an analysis in hand, the company management also will be able to decide the cost of attaining the load objective and whether or not it decides to go for it. If not, the goals will have to be adjusted but

they can be adjusted with more intelligence.

A sales point of view will definitely be needed by all the division managers in the future, McGonigle felt. To preserve their autonomy and the spirit of competitive enterprise as a company and as a staff, the entire viewpoint will have to be toward sales and development of business in the future.

Meanwhile, the headquarters staff of Montana Power during the war has been reduced to a minimum. D. J. McGonigle has assisting him Robert McDonogh, as commercial and industrial utilization manager, and then the utilization personnel in the divisions. A few of the home service girls are still working in some divisions and are called upon to do all manner of odd jobs, teach nutrition classes, give customer service and advice, teach the use of appliances, teach users appliance care, assist in bond drives and other public-spirited war activities.

However, the staff is down to a minimum, and McGonigle feels that virtually a new organization will have to be built from scratch when the war is over. It is his desire to build this organization on the basis of ability and fitness and to make it a hard-hitting, energetic sales organization. He likewise wants to help the dealers to become as strong sales outlets as possible in the postwar period.

Utah Program Starts With Organization

WITH a goal of 2,000 kwh. per customer and a continuation of its policy of no merchandising, inaugurated before the war, the sales department of Utah Power & Light Co. has begun its analysis of the postwar program it intends to carry forward by beginning with a study of organization. W. A. Huckins, sales manager, in viewing the type of load served by the company in Utah, makes his approach through personnel. He has set up in outline the headquarters organization which he intends to have, made a job analysis of each of the staff positions and is using this as a nucleus for his future development of the plan which will go into a study of markets and consumption by various classes of customer.

He visualizes the headquarters staff as having a residential, a commercial, and an industrial manager and adding to it a farm and a training manager in addition to the home service director. These, together with a chief clerk and the advertising and promotion manager, would constitute the headquarters staff.

The residential director and home service director would work with dealers for the development of the appliance market. The commercial and industrial directors would work with commercial establishments and industries in the region for expansion of commercial and industrial lighting and power.

The importance of agriculture to the company's load would be developed through a new farm load director. Likewise, since so much of all the organization will need to be rebuilt, training will be more important than ever and a director of sales training will handle this in cooperation with each of the other department heads in their respective classes of service.

Similar organizational study will be made in each of the divisions and be based upon the character of load in each division and the necessities for staffs to develop load in each category.

Estimates of the cost and budgets for operation are also being developed to make the program as complete in detail as possible.

As the first step in the program, a series of meetings has just been completed throughout the territory of both Utah Power and of Western Colorado Power, following a survey made in the area. Huckins led a group of the staff organization, including M. L. Cummings, advertising and sales promotion manager, J. F. McAllister, residential sales manager, J. H. Shaw, commercial sales manager, and G. B. Walker, industrial sales manager, which visited every division and held meetings with the utility staff there and then with dealers, contractors, wholesalers and manufacturers representatives.

In these meetings, Huckins outlined the company's policy, reiterated its theme, *Sell Better Living Electrically*, told of customer increases of approximately 4,400 per year for each of the past seven years. A total sales force of 44 at present, including divisional personnel, is to be increased to 83. This means six farm specialists, seven home service specialists, nine domestic salesmen who will even assist dealers to close sales.

"It is possible that in certain instances we may want to go so far in our assistance to dealers as to have power company salesmen available to go out into the field with dealer salesmen, assisting them in the sale of equipment," said Huckins. Their regular assignment, however, will be to contact builders of new homes, follow through on wiring promotion, lighting, stoker and other special electrical application promotion.

Six more commercial men and two industrial men will be added also.

McAllister declared that the aim of the domestic staff will be two-fold, first to work with users to assist them to use their electrical equipment to better advantage, create a desire for more of it, impress upon them the dependability, reasonableness and value of electric service; second to aid dealers, wholesalers and manufacturers to make more sales of electrical equipment.

An indication of market possibilities was given by McAllister when he

For better planning of its postwar agricultural program, Utah Power & Light is using this display as a feeler to gauge trends in farm electric use

Utah Power held meetings in adjacent trade areas to tell its postwar plans to employees, dealers and contractors. This meeting was in the Preston area.

said that only 17% of the company's residential customers now use automatic coal stokers; 90,000 homes have electric refrigeration and present a minimum market of 10,000 refrigerators in the postwar years; 55,000 families cook with electricity and 6,800 ranges should be sold after the war; 19,000 radios per year were sold prior to the war; 7,000 families would buy vacuum cleaners and 10,000 buy washers if they were available today; 6,000 electric water heater users out of 55,000 range users still offer a large field for sales in this field.

Shaw told of a commercial survey which revealed that of 602 customers contacted, 237 plan to improve lighting, 145 to remodel, 49 to purchase air conditioning equipment, 44 refrigeration equipment. Since 75 to 90% of all commercial lighting now in use will be considered obsolete because of equipment advances, Shaw said, approximately $400,000 worth of lighting fixtures and $200,000 of tubes and lamps should be sold the first postwar year. Wiring installations would add to this business potential.

Walker said that industrial lighting, process heat applications, air conditioning and general motor applications would furnish a market for industrial sales in the future.

● RESPONSE for the booklet *Your Next Kitchen*, prepared by Edison General Electric (Hotpoint) Appliance Co., Inc., has been widespread and especially strong from the West, according to reports from that company. Offered in national advertising to anyone who sends in a dime, the number of coupons and dimes has exceeded 12,000 per month. Since actual money is required, the interest in these is considered to be greater than for usual coupon clipping. The booklet itself is handsomely done in color and provides a card and an order plan sheet by which plans for one of the kitchens illustrated may be ordered. The layout sheet furnishes the company with a floor plan from which it can make a layout to send to the one making the inquiry.

● PRIORITY RESERVATIONS on the purchases of major electrical appliances were promised the public in Vancouver, B. C., by David Spencer Ltd. in a seven-column full page advertisement recently. Pointing out that it could not predict how long it would be before such appliances would be available, it knew there would be an enormous demand. Stating that the firm did not immediately anticipate receiving stocks yet it wished to assure fair distribution to those in need, prospective purchasers were asked to fill in a priority listing application. This would place them on a reservation list in order of its receipt, without obligation to buy. Reservations were not accepted by telephone but had to be mailed in or delivered.

FHA Plan Opposed

Action was taken against the general proposal that builders include all essential appliances in the original purchase price of an FHA home, increase the down payment, but include it in the 25-year payment plan by the Retail Furniture Assn. of California and the Western Furniture Conference, both of which passed resolutions condemning such a distribution method.

The resolution, signed by H. F. Barger, president, and George W. Fitch, secretary and managing director, of the Retail Furniture Assn., gave these reasons:

"Depreciation on such appliances is much more rapid than on the house itself. Replacements because of obsolescence or new types of appliances would be retarded. Qualities of appliances, quantities produced and the progress of the entire appliance industry would be limited. This would result in greater costs for repairs, maintenance and replacement. The problem also arises, who will be responsible for service on these appliances—the power company, the builder, or the manufacturer, as it is doubtful whether the retailer could afford to give service?

● SAN DIEGO will have a home planners' institute too. An informal "steering committee," which has been set up representing the various groups in the home building industry, among them the electrical, began preliminary meetings July 6 to make plans for a fall term institute. The Bureau of Radio and Electrical Appliances of San Diego County was active representing dealers and distributors to take care of the wiring, lighting, home appliances and heating portions of the institute program.

Survey Appliances

Age and condition of domestic household appliances have been reviewed by the Office of Civilian Requirements, War Production Board, and the findings published in a third survey through the help of the Bureau of Census. Results, based on replies from about 4,500 households geographically and economically representative of the nation as a whole, told of the repair status, the age and the quantity in domestic use of 23 appliances. Among these were electric toasters, electric irons, fans, radios (excluding auto), vacuum cleaners, sewing machines, refrigerators, washing machines, electric ranges, electric heaters, electric water heaters.

Radios stood at the top of the list as most in need of repair followed by vacuum cleaners, washing machines, electric ranges, irons, sewing machines.

"Although more than half of the appliances are five or more years old, the percentage found to be in working order ranges from 85% in the case of radios to 99% in the case of several items of heating equipment," the report said.

Estimates of percentage of appliances not in working order are:

Radios needing repair, 15%; water heaters, 1%; sewing machines, 5%; toasters, 7%; vacuum cleaners, 7%; fans, 7%; refrigerators, 2%; washing machines, 5%; irons, 6%; ranges, 3%.

● EUREKA VACUUM CLEANER CO. has entered the field of electric irons. It has acquired the Cheraton cordless electric iron, George T. Stevens, vice-president announced, and will produce the iron as one of a group of new household products. The new iron will carry the Eureka name. It is to be operated without a cord, drawing its heat from a thermostat-controlled electric safety base. The iron is designed to retain the heat for considerable time through a sponge-like heat absorbing pressure plate inside the iron. The heat control governs the temperature required for various materials. Eureka also announced that it had a number of other products in mind to supplement its new vacuum cleaner units.

Television

Comes down to earth as genuine possibility

TELEVISION begins to assume the aspect of reality. Following a series of meeting in Denver, Seattle, San Francisco and Los Angeles at which General Electric Co. radio and television executives outlined in considerable detail the equipment for television, frequency modulation and amplitude modulation broadcasting and offered a plan to reserve such equipment on a priority basis, television came down to earth as a genuine possibility, as real as FM broadcasting and its mate, the pioneer AM broadcasting.

With its experimental station at Schenectady, much of the primary technique has been brought up through the proving stages and many of the technical difficulties which confronted and baffled the industry before the war seem to be solved to a point which makes such broadcasting practical.

Speaking to these Western meetings were W. R. David, G-E sales manager of broadcasting equipment, Schenectady; J. D. McLean, sales manager of the television broadcasting department, Schenectady; Walter M. Boland, manager of the Western District, and P. G. Coldwell, Western District engineer. R. M. Alvord, G-E vice-president, San Francisco, opened the meeting in that city.

Because there will be a postwar market of 12,500,000 radio sets and if one out of every four buys an FM receiver, David predicted a tremendous market. He showed how few of the present 60,000,000 receivers were working satisfactorily, according to a War Production Board survey. Fully 15% are inactive and out of use, 28% work poorly and approximately 14,000 fail every day and go permanently out of service. This has affected the AM audience. Any receiver in the future not FM equipped will be obsolete when sold, he declared.

He predicted three changes after the war. First would be a big increase in FM stations, possibly some 500 throughout the United States as against the present number of 53; second, modernization of many radio sending stations, some of them switching to FM and a possible reduction from the present 900 stations to approximately 750 AM stations with consequent improvement of AM reception and broadcasting; third, television as a separate broadcasting enterprise. He mentioned that a fourth might be expected, the broadcasting of facsimile which would "give the listener a soap coupon simultaneously with the soap opera."

Walter Boland followed with an estimate that there would be a backlog of 20,000,000 sets to be sold immediately after the war, saying the largest previous year's sales had been 13,700,000 in 1941. To predict when sets will be made again is something else, for the government is now taking and will continue to take the full electronic production of all manufacturers. How long after the war it would be before sets would be made he estimated as about 90 to 120 days, depending on the suppliers of component parts for sets. He predicted an FM model would be made in all of the price brackets.

As for television, McLean explained that master broadcasting stations could be established in the larger population centers. He predicted that networks would be developed using ultra-high frequency relay stations rather than wire services and that from these networks many low-power, low-cost satellite television stations could be set up to provide program service in smaller population centers. These with portable equipment could provide even local television programs for local audiences. At least 100 master television stations were envisioned for the country within five years after the war.

Boland exhibited drawings of possible table and floor model receivers for television and combined with radio and, likewise, predicted industrial television systems for use in stores and factories. By means of these, fashion shows or displays could be broadcast throughout a building or store so that larger numbers of people could see the displays and programs.

A plan whereby broadcasters and prospective broadcasters may reserve equipment either for rehabilitation of present stations on AM frequencies or for FM or television was explained by Caldwell. A deposit in war bonds gives preference to the buyer and enables the manufacturing company to gauge its market and set up manufacturing facilities to produce in the postwar period.

● TO FORESTALL an inevitable reaction from the public in regard to sharp practices in the radio repair business, the Bureau of Radio and Electrical Appliances of San Diego County has decided upon energetic action through a "radio ethics committee." Finding that its previous statement that 25 radio service shops had started business in its territory in the previous three months was only half the story, the bureau has decided to seek to correct many of the abuses which are bringing a bad name to the industry.

War Surpluses

H. G. Burrows, division engineer of the Defense Plant Corp., met with a group of San Francisco distributors of various classes, electrical, industrial, plumbing, etc., on Aug. 23, frankly seeking advice and cooperation on the matter of best procedure in the handling of war surplus property on the part of the disposing agency. F. S. Leaver, of the San Francisco Loan Agency, RFC, Small War Plants Division, was also there.

Burrows explained that there is a necessity for starting to move the surplus goods rapidly. His contention is that these goods should be channeled through the distributors. But how to go about it was a problem. Who are the recognized distributors and who are the speculators? He needed help in determining this and proposed that some sort of committee be set up, possibly, to whom he could turn when bids come in, and who would advise which were recognized distributors and which speculators.

This question was answered for him by referring him to the secretaries of the local trade associations in the various fields. It was declared these could readily give him the information or suggest the names of a number of men in their various groups who could act for him as guidance committees in this respect.

Certain of the distributors brought up the point that on various lists of surplus materials, distributors are at sea because there is no indication of the status or condition of the goods—whether new, used, slightly used but in good condition, unused but injured by weathering, etc. Also, there is no information whether quantities are open or broken package lots. At a distance, due to transportation difficulties, the distributor cannot inspect before making his bid. Frequently he is "stung," so to speak. Burrows then put this down as one of the conditions that might be remedied, at least in the Western division.

He then advanced an idea of his own which he thought the distributors were aware of but which turned out to be news to them. When a bid is made, the price quoted must be submitted to Washington for approval. While he promised prompt advice from headquarters, he said it was a long way off and that some sort of explanation of the price, covering the method for arriving at it, market conditions, etc., should accompany the bid and thus enable Washington to determine that it was a fair price, all things considered. That procedure, he said, would help materially in obtaining prompt approval.

Pretty Sharp

He gives his name the meaning which "sharp" holds for the teen agers, does J. Vernon Sharp, electrical dealer and contractor of Salt Lake City. Any man can go out of business when there seems to be no merchandise, but that's not the Sharp thing to do. Vern Sharp found some merchandise, lots of it, and of good quality and, with just enough sparkle from the remnants of his electrical fixture stock left to identify the store as still in the electrical business, he has weathered the war. Vases and candlesticks he wired to make lamps. Hotplates were fashioned for desperate customers from range elements. Repairs have kept him and his brother busy. Since these pictures were taken of the attractive store, Sharp, who once lived in Mexico and speaks the language, went down and brought home $10,000 worth of Mexican goods, leather work, wool blankets, serapes, sport jackets, silver and feather work, etc. "In fact you would think you were in old Mexico. We would even talk Spanish to you."

Nisqually Development Adds 90,000 kw.

Tacoma City Light builds new plant and adds to another to meet increased power demands and retain local autonomy. Wartime construction obstacles are overcome on $23,000,000 hydro development

*Verne Kent and V. B. Jones**

Building a new highway was part of the Nisqually job. Below is a view of the new and much improved highway and, in the background, Mt. Rainier, whose Nisqually Glacier will furnish the water to develop 114,000 kw. in two plants. In the photograph above is shown the new La Grande diversion dam. Trash racks and intake structure for tunnel are shown in the center background. Tainter gates provide spillway capacity of 78,000 cfs. Dam is 250 ft. in height

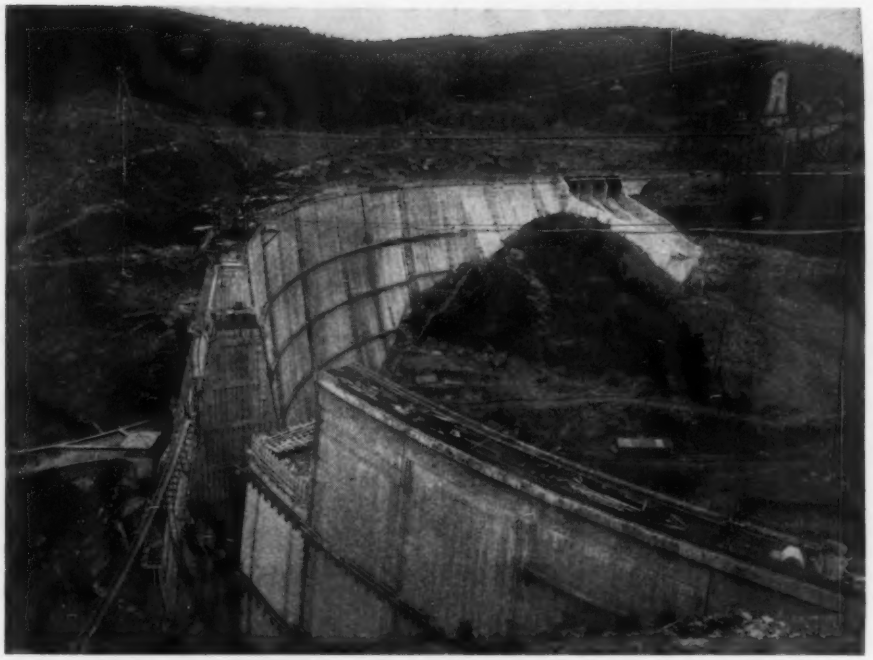
FOR over fifty years Tacoma City Light has, through a normal and orderly process, expeditiously expanded its facilities to meet its steadily growing load. In the face of continued demands for more and more low-cost power, and with conservative forecasts showing further growth assured, engineering studies were made of several available sites. These finally narrowed down to, and resulted in, the selection and approval of what is known as the Second Nisqually Development, now nearing completion.

Due to upset world conditions, some thought was given prior to construction to purchasing Tacoma's additional power requirements from adjoining utilities. However, this was not found feasible when consideration was given to the fact that Tacoma's low rates are predicated upon continued self sufficiency and local autonomy. Then came Pearl Harbor, increased costs, labor and material shortages, and governmental restrictions. Further study was made of the proposition of purchasing power from other utilities. However, there still remained considerable economic justification for the projected expansion program aside from the many intangible advantages inherent in continued local autonomy, and not possible under certain forms of long-term firm power contracts heretofore tendered the city.

On April 15 and June 4, 1942, respectively, contracts were signed with L. E. Dixon Co. of Los Angeles as general contractor, and West Construction Co. of Seattle, for the construction of a two-dam, 90,000-kw., 400,000,000-kwh. project. In May 1943, the engineering firm of Charles T. Main Inc., of Boston, was retained to provide engineering supervision to further expedite the project to its ultimate conclusion.

Although the construction program was (and is being) carried on more or less simultaneously throughout, it will be noted from the accompanying drawing that there are several sizable jobs within the project, each of which constitutes a fairly large undertaking in itself.

* Superintendent and engineer, respectively, Department of Public Utilities, City of Tacoma, Wash.



330-ft. Alder Dam will impound 210,-800 acre-ft. of water. The same water later passes through the LaGrande plant with 64,000 kw. installed capacity. Dam crest is about 1,500 ft. long

Alder Dam

Alder Dam, the largest single unit, is a variable radius arch type concrete structure, 330 ft. high and approximately 1,500 ft. long, containing about 440,000 cu. yd. of concrete. It is 120 ft. thick at the river bed and 15 ft. thick at the top. A 12-ft. roadway with walks and parapet walls extends along the entire crest of the dam. This structure is located on the Nisqually River at the base of the Cascade Mountains, 30 to 35 miles southeast of Tacoma, and about 1¾ miles above the present 24,000-kw. stream-flow plant constructed in 1912, at La Grande, Wash.

The Nisqually River has its source in Nisqually Glacier, on Mt. Rainier, about 60 miles southeast of Tacoma. Area of the Nisqually Glacier watershed to the project site is 289 square miles. At this point the river has an average stream flow of 1,296 cfs. and an annual runoff of 936,653 acre-ft.; a maximum recorded flood of 24,000 cfs. and a maximum yearly runoff of 1,384,000 acre-ft.

Two steel penstocks, each 10 ft. in diameter, with an upstream center-line elevation of 985.0 ft., pass through the dam near its base. A river outlet pipe, 6½ ft. in diameter, passes through the dam at upstream center-line elevation 972.5 ft., and will be controlled by an S. Morgan Smith Howell-Bunger regulating valve below the downstream face of the adjoining Alder power house. The river outlet pipe and the two penstocks are protected by an emergency bulkhead type gate, and suitable trash racks at the upstream face of the dam were provided.

The model tested, concrete lined spillway is of the overflow type, with a capacity of 78,000 cfs., controlled by four Tainter gates, each 23 ft. high and 32 ft. long. This capacity is equal to approximately three times the maximum recorded flood of the river.

Alder reservoir, created by the dam, is scenically situated along the Mt. Rainier National Park highway, and is roughly 3½ miles long and averages a half mile in width. It provides a total storage capacity of approximately 210,800 acre-ft., of which 158,800 are usable, assuming an 86-ft. drawdown. The maximum normal reservoir elevation is 1,200 ft., with an extreme design flood-level elevation of 1,207 ft.

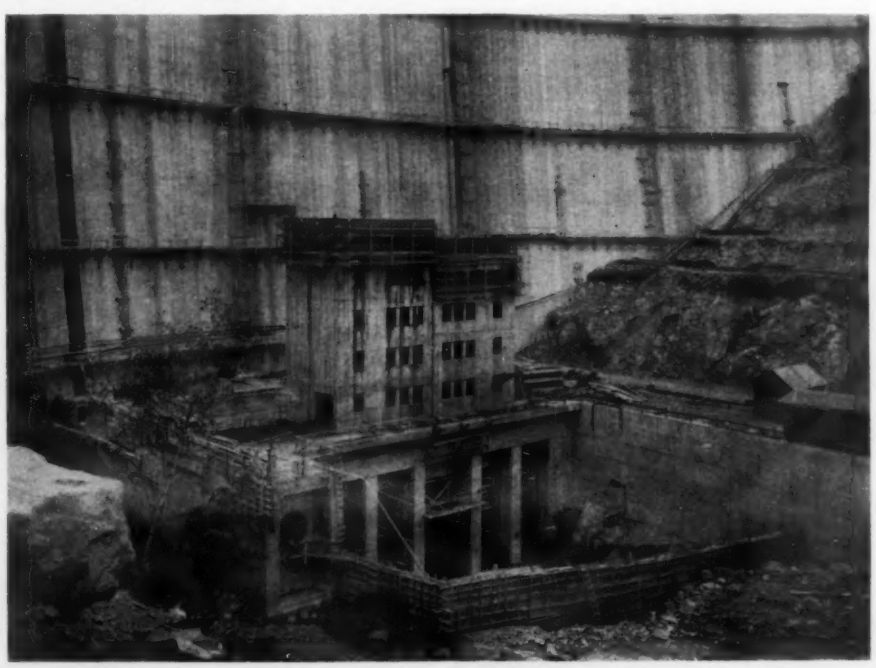
Alder Power House

A 50,000-kw. plant of reinforced concrete and steel-frame construction, known as the Alder power house, is located in the river channel immediately downstream from the base of the dam. Housed therein will be two 25,000-kw. 13,800-volt, 60-cycle, 225-rpm. General Electric generators driven by 34,500-hp. Francis type Pelton vertical turbines operating under a range of from 178 to 273 ft. of net head.

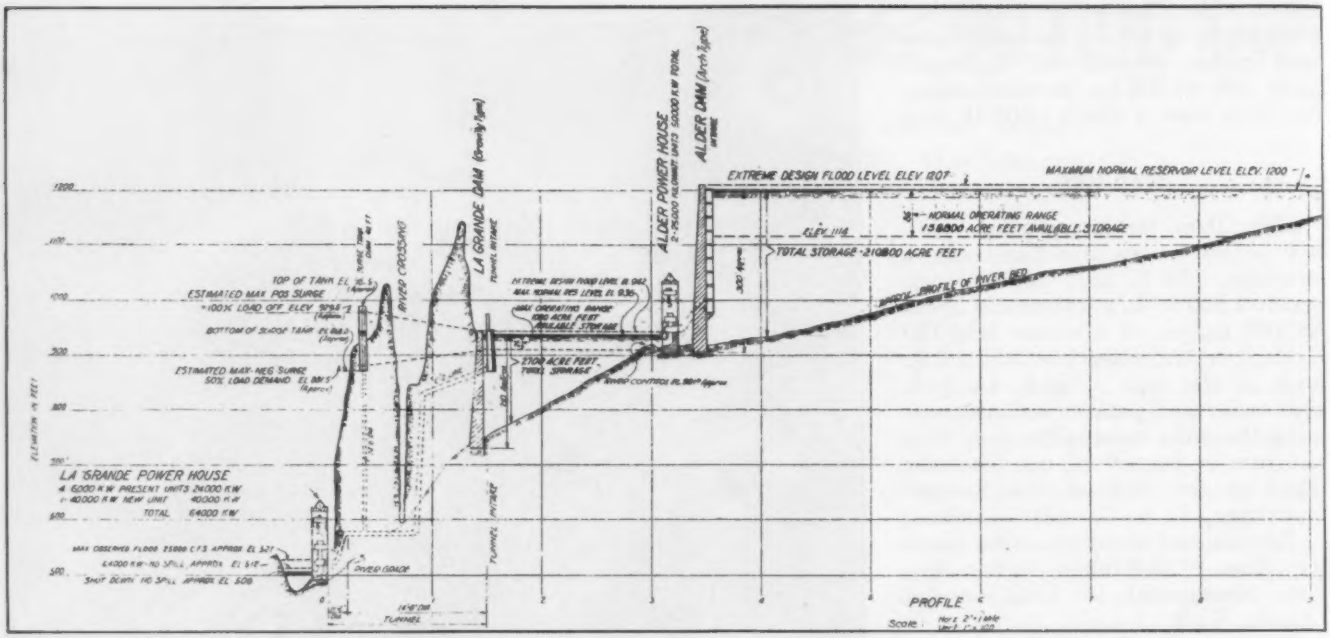
Each turbine, in addition to having the usual appurtenances, will be equipped with a 10-ft. butterfly valve. A 100-ton Harnischfeger traveling bridge crane, together with one 25-ton auxiliary hook, will serve the operating floor. This plant, under average stream flow conditions, will produce approximately 174,000,000 kwh. annually.

La Grande Dam

La Grande Dam, a concrete gravity structure, is located approximately 1.5 miles downstream from Alder Dam. It is essentially a diversion dam for the La Grande tunnel but provides a total pondage of approximately 2,700 acre-ft., of which about 1,000 acre-ft. is



Alder power house will contain two 25,000-kw. units operating under a head range from 178 to 273 ft. Two steel penstocks, each 10 ft. in diameter, pass through the base of the dam



Profile shows major features of the second Nisqually project—Alder Dam and Power House at right, La Grande diversion and new La Grande plant

usable for regulation, assuming a 25-ft. normal operating range. The dam is 215 ft. high and 500 ft. across the top. It is 164 ft. thick at the river bed, 12 ft. thick at the top, and contains 84,500 cu. yd. of concrete. Located in the center portion of the dam is a spillway controlled by four Tainter gates with a capacity of 78,000 cfs. A 12-ft. roadway with walks and parapet walls extends over the dam and bridges the spillway.

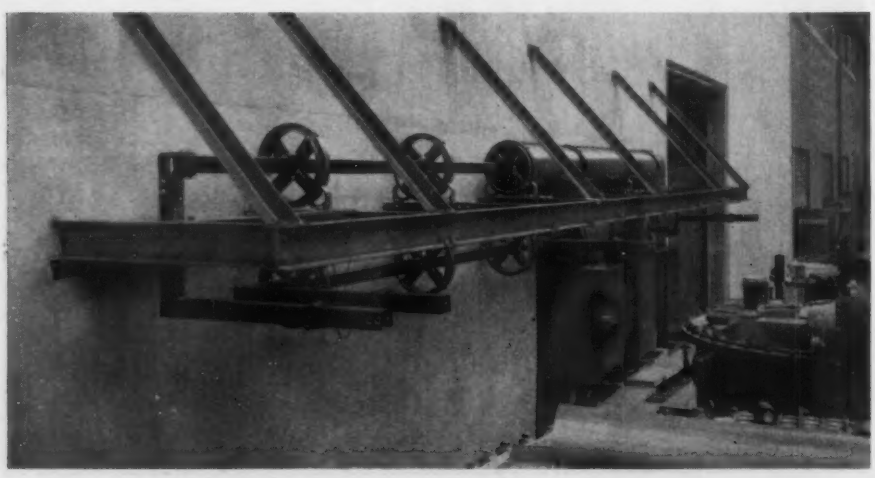
A 14½-ft. concrete lined tunnel, 6,200 ft. long, leads from the La Grande Dam to the La Grande power house, which consists of the old La Grande plant plus a new 40,000-kw. addition. The tunnel is provided with a steel plate differential surge tank 40 ft. in diameter and 115 ft. high. The reinforced concrete tunnel intake structure is located about 40 ft. upstream from the La Grande Dam, near the left abutment, and is complete with trash racks and caterpillar type tunnel closure gate and hoist, by-pass valve and other necessary control appurtenances.

La Grande Power Plant

Adjacent to Tacoma's existing 24,000-kw. plant at La Grande there is located a new power house addition, essentially of reinforced concrete construction, with a concrete encased steel-frame superstructure. The new addition houses a 40,000-kw., 13,800-volt General Electric generator actuated by a 54,000-hp., 257-rpm. Francis type Pelton vertical turbine, operating under a net head range of from 378 to 416 ft. The turbine is equipped with a 10-ft. butterfly valve, relief valve and Woodward governor. A 200-ton capacity Cyclops double-trolley traveling bridge crane with two 15-ton capacity auxiliary hooks serves the operating floor.

Average year output of the new 40,000-kw. addition will approximate 226,000,000 kwh. annually. The corresponding annual output of the present 24,000-kw. installation is 150,000,000 kwh. Thus, the total capacity of the La Grande plant only (excluding the new 50,000-kw., 174,000,000-kwh. Alder plant) will be 64,000 kw., with annual output of 376,000,000 kwh. under average stream flow conditions.

Secondary to the construction of the dams and power plants, but an important factor in the over-all cost picture, was the railroad and highway relocation. This necessitated the removal from the river canyon of a section about 14 miles long, of the Tacoma Eastern branch of the Chicago-Milwaukee-St. Paul and Pacific Railroad, to a new site. A two-mile section of the Rainier National Park highway was relocated to higher ground and, in cooperation with the State Highway Department, considerably improved.



Installing outdoor section of isolated, metal-clad, 13.8-kv. generator bus to the low side of the transformer bank for La Grande power house addition

Electrical Features

In general, the electrical features are similar in both the Alder and the La Grande plants. Isolated phase 13,800-volt metal enclosed bus structures (1,200 amp. at Alder, 2,000 amp. at La Grande), by R & IE Co., are designed to minimize bus faults to single-phase to ground. The generator neutrals are ungrounded, with connections to ground through potential transformers only. There is less tendency for iron burning under these conditions. The generators and 13,800/110,000-volt step-up transformers are connected solid, as a unit, through dis-

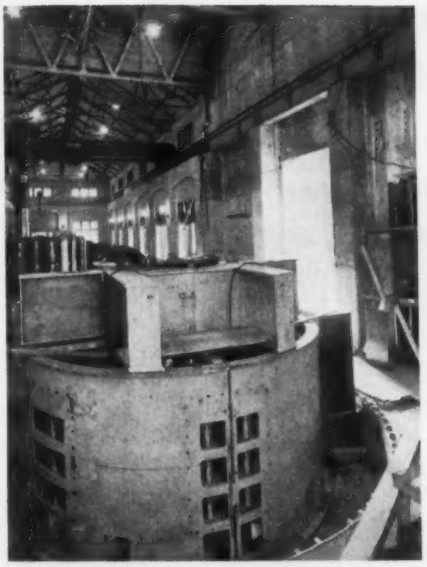
connects. The generators and transformers are protected with differential relays for phase faults, and the generators with voltage relays in the neutral for ground faults.

Station service at Alder is provided through 13,800/440-volt transformers from each of the two 25,000-kw. generators. At La Grande, a 13,800/440-volt transformer on the new 40,000-kw. generator and a 6,600/440-volt transformer from the existing 6,600-volt bus provide station service. In addition, a nominal 6,600-volt intertie between the Alder and La Grande plants provides suitable station service standby.

Transmission Lines and Substations

Two original wood-pole transmission lines, built in 1912, connecting La Grande power plant and the Nisqually substation in Tacoma, were 4/0 all aluminum, insulated for 50 kv. When the Second Nisqually Development was proposed, it was deemed advisable to include in the construction program plans for building two 350,000-cir.mil. copper lines to carry the combined output of the old and new plants. However, because of the critical material situation, it was agreed that the two existing 50-kv. lines would be reinsulated for 110 kv.

The project required the installation of new poles, cross arms, insulators and hardware on both lines for 25 miles; re-arming existing poles for 11 miles; and the construction of 2½ miles of new wood-pole lines using the city's standard wishbone configuration. Osmosalts treated class 2 western red cedar 60-ft. poles, with an average setting depth of 8 ft., spaced 330 ft. apart, were generally used throughout except for a short distance where localized swamp conditions dictated otherwise.



An extension to the original LaGrande plant houses a new 40,000-kw. unit soon to go into operation. Two halves of stator and rotor were lowered into deep canyon from overhead cableway

A temporary unattended switching station had to be built near the city's outskirts, as a terminal for the reinsulated 110-kv. lines. A new terminal and extensive improvements, including the installation of two 20,000-kva., 720-rpm. synchronous condensers, at Tideflats substation completed the program in this respect.

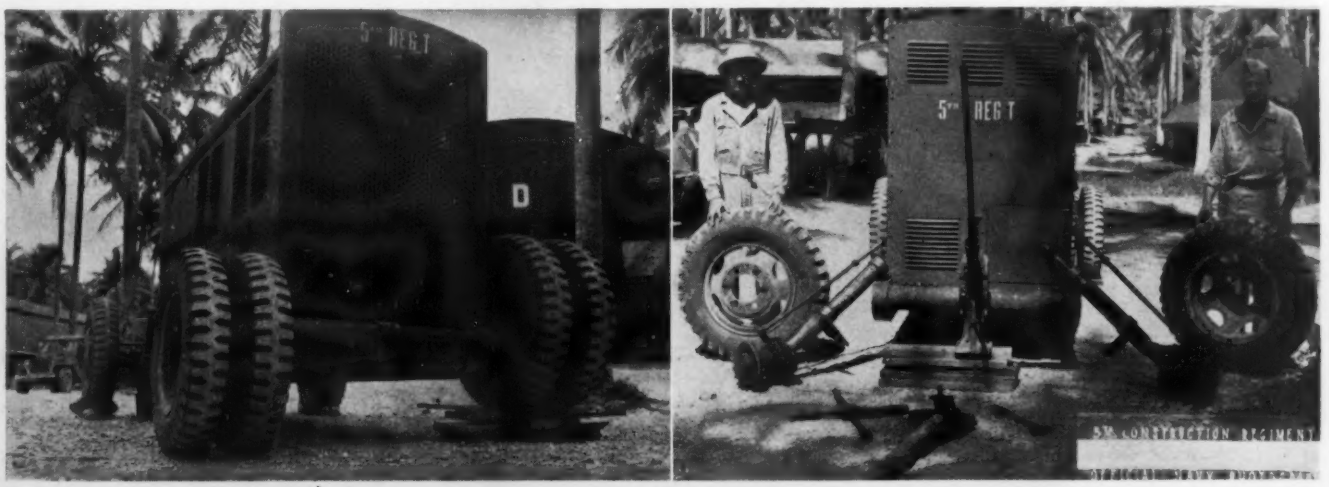
System Capacity

The total capacity of the old La Grande plant on the Nisqually River and of the completed Second Nisqually development, will be 114,000 kw. and 550,000,000 kwh. annually under normal stream flow conditions. In addition, Tacoma City Light has a 90,000-kw. 300,000,000-kwh. development, known as Cushman plants 1 and 2, on the North Fork of the Skokomish River, in the Olympic Mountains The combined hydro capacity will be 204,000 kw. and 850,000,000 kwh. Maintained normally in good condition as cold standby, with a skeleton crew for emergency use, Tacoma's two steam plants provide an additional 34,000 kw. and 238,000,000 kwh., based on 80% plant factor.

With one development in the Cascade Mountains and another in the Olympic, two separate and distinct watersheds, Tacoma City Light will be able to take full advantage of diversity in stream flows, thereby increasing reliability and efficiency.

Interconnected with Seattle City Light and the Bonneville-Coulee systems, Tacoma is a member of the Northwest Power Pool which consists of eleven of the largest municipal, private and governmental utilities in the five northwestern states of Washington, Oregon, Idaho, Utah and Montana. In the aggregate, the combined capacity of the pooled systems approximates 3 1/3 million kilowatts.—(ELECTRICAL WEST, March 1944).

Seabees in the South Pacific use extensively 75-kw. Diesel-electric generating units of the type illustrated. They are used singly or in banks to supply an entire camp. To eliminate use of badly needed cranes to move these units, the Seabees make use of a 4-in. steel pipe cross-brace, front and rear, as an axle housing and install running gear as shown. An offset shackle between axle and wheel spindle permits the "vehicle" to negotiate uneven ground and also absorbs some of the shock from the springless chassis. Only a few minutes is required for two Seabees to install the axles and wheels, attach the tongue to a jeep, and haul the unit away. No job is too tough for the Seabees



54,000 Hp. Powers New Wind Tunnels

Full-sized planes may be tested in Moffett Field wind tunnel and Boeing installs fastest tunnel where air velocities will approach the speed of sound. These, with other wind tunnels building and built, focus attention on the West in aeronautical research

TWO of the nation's most outstanding wind tunnels for aeronautical research have recently been placed in operation, one at Moffett Field, near Sunnyvale, Calif., and the other at the Boeing plant in Seattle. Each has distinctive features. Ames Aeronautical Laboratory, built and operated by the National Advisory Committee for Aeronautics at Moffett Field, has the largest wind tunnel ever built, and the Edmund T. Allen Memorial Aeronautical Laboratory at Boeing contains the fastest large wind tunnel yet constructed. Both are interesting from an electrical standpoint, embodying huge motors, special means of controlling speed and other noteworthy features.

Moffett Field

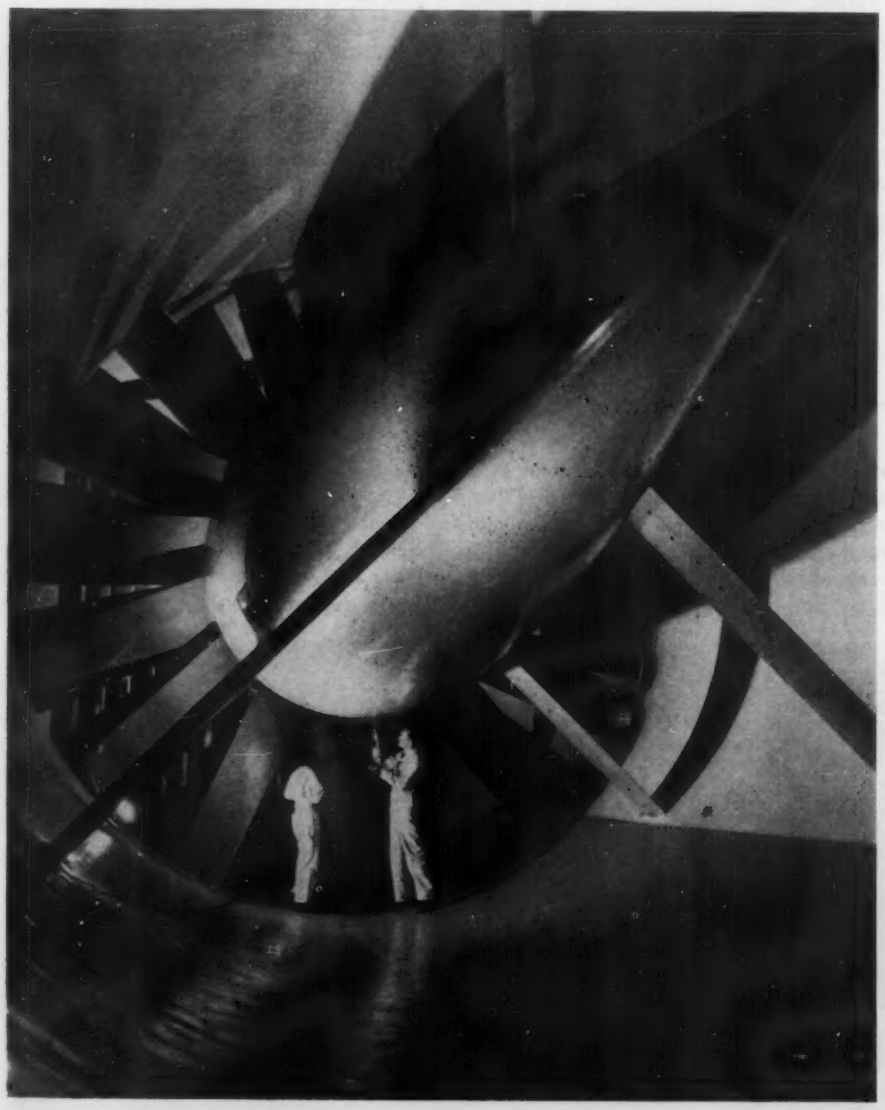
Air supply for the large wind tunnel at Moffett Field is supplied by six 6,000-hp., synchronous motors furnished by Westinghouse Electric & Mfg. Co. Each drives a six-bladed spruce fan 40 ft. in diameter to create the man-made hurricane in the 40x80-ft. test section. This test section is large enough to accommodate a 14-passenger Lockheed Speedliner with wingspread of 65½ ft., or will take a 1/3-scale model of the big Douglas B-19, whose wingspread is 212 ft. Such a huge model would have a wingspread of nearly 71 ft., actually greater than the Speedliner.

The six motors are mounted in two horizontal rows of three as shown, one row above the other, in a 90x120-ft. section of the wind tunnel opposite the test section. Center line of the top row of motors is nearly 90 ft. above the ground level. A modified Kramer control provides accurate speed regulation over a range from 50 to 288 rpm. The 30,000 kw. required by the motors is stepped down from a 110-kv. Pacific Gas and Electric line to 6,600 volts for the motors.

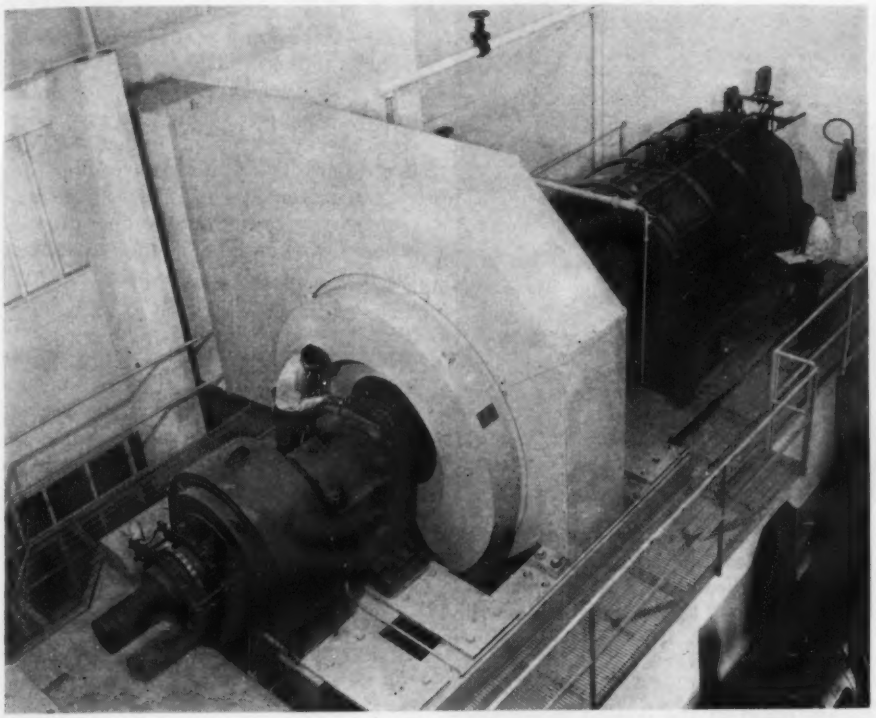
The modified Kramer control not only provides the extremely accurate speed control necessary, but serves as well to start the motors without drawing excessive current from the transmission line; enables synchronized operation of the six motors over a wide range of speeds, and converts a large percentage of power losses inherent in the system back into usable energy. Motor-generator sets used in the modified Kramer control are even larger than the 6,000-hp. motors, one set measuring 39 ft. long by 11 ft. high.

Boeing Wind Tunnel

The wind tunnel at Boeing is for testing models only, having a test section 12 ft. wide through which air may be driven at velocities in the region of 700 m.p.h., only slightly less than the speed of sound. This, the fastest large tunnel in the country, is powered by a 12,000-hp. constant-speed, 514-rpm. motor built to Boeing specifications by Westinghouse Elec-



The immense conical hub fairing lends an eerie aspect to the 16-blade fan which creates a hurricane near 700 m.p.h. in the new Boeing wind tunnel. The fan is 24 ft. in diameter and has top speed of 490 rpm. High-speed research will be aided by this tunnel



Wind velocities approaching the speed of sound are produced in the Boeing wind tunnel by this 18,000-hp. motor (in metal housing). On the near end of shaft is the 400-hp. motor to start the larger motor to prevent severe bump on the power line. The magnetic clutch for speed control is shown on the far end of the shaft which extends through the wall to the propeller fans

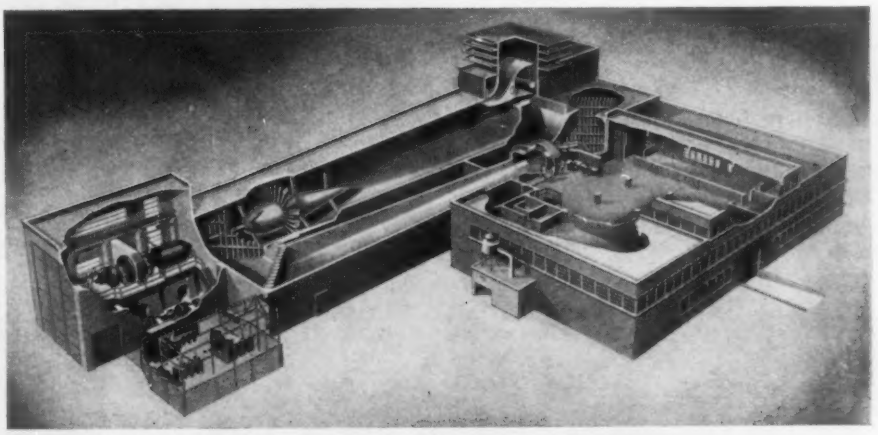
tric & Mfg. Co. The huge motor has sufficient overload capacity to develop 18,000 hp. for short periods of approximately 20 minutes.

Careful planning of the plant, built for Boeing by the Austin Co., has resulted in a highly efficient electrical system. A special substation was built to step down from 26,000 volts to the 6,900 volts required by the motor.

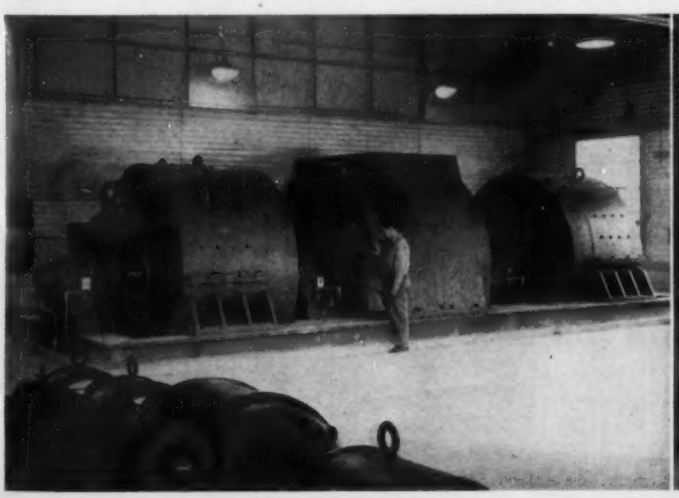
The main motor, 11 ft. in diameter and weighing 60 tons, is direct connected to a 16-blade, 24-ft. fan through a magnetic coupling built by the Dynamatic Corp. Speed control by this clutch may be had within one-tenth of one per cent, plus or minus, of the rpm. desired. The main motor is of such size that a 400-hp. direct-connected starting motor is required to bring it up to speed in order to prevent excessive bump on the power system. The three-unit main motor, starting motor and magnetic clutch is shown in one of the accompanying illustrations.

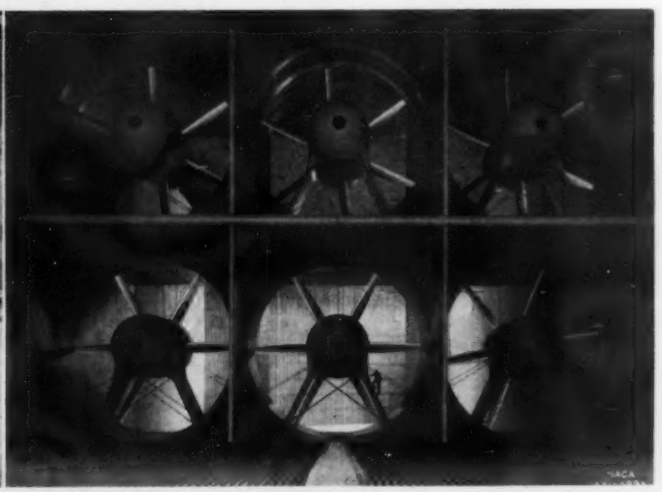
To Further Research

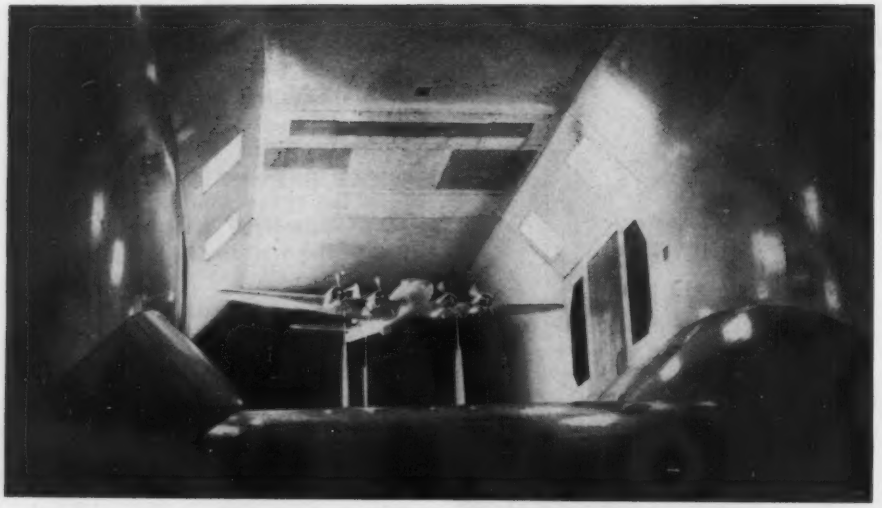
Rushed to completion in a little over three years to do a vital wartime research job, the Moffett wind tunnel will enable designers to discover and correct undesirable characteristics directly on full-sized planes, with the margin of error reduced to zero. With its continued use as a national research labratory, this $7,000,000 plant will test military and commercial aircraft of the future, at the



Above: Artist's cutaway of the Boeing wind tunnel, showing power unit, operations room, offices, tunnel, power substation, motor and clutch, large fan, with hub fairing, the turning vanes and other features of the installation. Below, left: Variable-speed motor-generator set, with exciter set in the foreground, for full-scale wind tunnel at Moffett Field. Middle unit is a 36,000-hp., variable-speed, synchronous motor. Below, right: The six 36,000-hp. motors, each driving a six-bladed 40- ft. fan. Top row of motors here is 90 ft. up







A scale model of the Boeing Flying Fortress is shown installed in the test section or throat of the Boeing wind tunnel in the laboratory at Seattle

same time acting as a check on smaller wind tunnels in which only models of planes can be tested.

The Boeing wind tunnel, with its tremendous air velocity, will permit attack on the barrier which confronts aviation engineers in their quest for greater and greater speeds. An indeterminate amount of research at the speed of sound, 741 m.p.h., is needed to find the answers to jet propulsion and other high-speed developments. There are other important wind tunnels at Moffett Field, and in addition two new wind tunnels have been built at the California Institute of Technology, all contributing to the intensive research in aerodynamics.

● X-RAY BURNS are a concern which affects the further use of X-ray equipment in industry. The American Standards Assn. has announced the initiation of a project to provide protection from X-ray burns in industry. Few, if any, city and state safety codes provide requirements to insure protection from X-ray radiation for operators or others working near the machines. Likewise, the portable type of machine which can be directed at any angle presents a particularly difficult safety problem. Unfortunately, some of the most serious effects of overexposure do not develop for years. The project will be carried on under the American War Standard Procedure which is given a priority rating on the ASA calendar. The National Bureau of Standards handbook (HB-20) on X-ray protection, governing the use of X-ray in the medical field, will provide a source of technical information for the project.

● TERMINAL MARKINGS need to be standardized. The fourth edition of the American Standard for Terminal Markings for Electrical Apparatus has just been completed under the sponsorship of the National Electrical Manufacturers Assn. and approved by the American Standards Assn. In view of the growing complexity of electrical apparatus, the necessity for terminal identification has increased.

The exciter set (left) located in the power room of the Boeing tunnel controls operation of the tiny electric motors which are installed in the nacelles of the small plane models being tested, thus duplicating precise flight conditions. This complex assortment of tubes, wires and switches (right) is the electronic speed control equipment for the main fan in the Boeing wind tunnel. Accurate control of fan speeds is of extreme importance to the operation

IAEI Studies Code Changes

Northwestern Section, meeting in Olympia, prepares for first NEC revision in four-year period

IN this year of preparation for the first revision of the NEC in four years, the program of the 18th Annual Meeting of the Northwestern Section IAEI was dominated by Article Committee reports. The meeting, held in Olympia, Wash., Aug. 21-23, was presided over by J. Hyde Stayner, Utah Power & Light Co., president, and had as its general chairman, C. M. Kirsop, electrical inspector, Olympia. Registered were 110 men and 36 women.

Revisions were recommended in 18 of the Code articles with the general effect of tightening the Code, clarifying its wording and returning to former standards that had had to be relaxed to some extent during the war period. The interim amendments of Articles 210 and 220, Branch Circuits and Feeders, as presented by W. L. Gaffney, chief electrical inspector, Tacoma, and L. W. Going, chief electrical inspector, Portland, were approved in substance. The report on Article 500, Hazardous Locations, by E. B. Morrison, Oregon Insurance Rating Bureau, Portland, repeated last year's recommendation of the Northwestern Section that the article treat of only two classifications—Class I, flammable gases or vapors, and Class II, combustible dust, and proposed a number of changes in many of the sections. Also approved in substance was the new Article 725 on Remote-Control, Low-Energy Power and Signal Circuits.

The meeting opened with a spirited address by Governor Arthur B. Langlie of the State of Washington, who put his stamp of approval on the legitimacy of a meeting of this type in wartime, since it was a meeting of specialists having an important wartime job and thus would contribute to the war effort. Urging the importance of looking forward to the postwar period, he stated that this group, in common with many other technical groups in the nation, would have important influence in shaping the country's destiny.

J. T. Trullinger, Mayor of Olympia, likewise welcomed the delegates, as did A. M. Chitty, division manager, Puget Sound Power & Light Co., representing the local electrical industry. Chitty stated he felt the industry would see great technical advances in the next few years after the war, referring specifically to electronics and television. President Stayner replied to these addresses of welcome, promising strict attention to business to make the meeting as valuable as possible.

First reference to building the Code back to prewar standards came from J. D. Lynett, supervising chief inspector in New York City, and president of the International association. He pointed to the $9,000,000 fire loss in New York prior to last war and the nearly $24,000,000 loss in 1923 after the war, ascribing a share of this increase to relaxed electrical standards and inferior workmanship of war-trained electricians. Somewhat the same trend may be expected after this war, he said, and we should keep inferior workmanship out of the business and go back to prewar standards of wiring as soon as war production conditions permit. He put in a plea for building up electrical inspection departments depleted by the war.

Much interest was evidenced in the six reports of the international postwar committees. The group heartily endorsed the recommendations of the committee on inadequate installation presented by F. H. Murphy, Portland General Electric Co., by agreeing that there should be an all-industry promotion of adequate wiring after the war. The committee on uniform codes, presented by W. R. Volheye, state inspector for Oregon, pleaded for a greater acceptance of the National Electrical Code as a means of achieving greater uniformity in city electrical ordinances throughout the country. I. B. Sturges, electrical inspector, Portland, presenting the report of the sales control committee, urged the name of sales control ordinances be changed to "electric equipment ordinance" to give it a positive rather than a negative connotation. No solution was offered to the problem of reinspections after the war, which the report of the postwar committee on that subject expected could become increasingly necessary.

The report of the public relations committee as presented by Capt. Stephen E. Sanislo, Seattle Fire Department, chairman, told of the promotion of the Electrical Safety Week in the State of Washington last May. A subsequent resolution passed by the group commended this type of promotion to the other states in the Northwestern Section as a section public relations activity, and further urged all the sections and the Executive Council of the IAEI to give consideration to extending the activity nation-wide.

An excellent paper on the 50 years of service of the Underwriters' Laboratories was presented by H. G. Ufer, Los Angeles, while Fred P. Oliver, Union Insulating Co., Parkersburg, West Virginia, gave a hint as to the future use of plastics in electric wiring. J. J. Sidall of the H. H. Robertson Co., Pittsburgh, gave an inspiring address entitled *When War Ends.*

One Code breakfast took cognizance of a problem that will be presented by shipyard and other war industry electricians planning to come into the commercial wiring business after the war. It was generally agreed that the training courses now being given to these electricians to attempt to make them into full-fledged journeymen would not be adequate for this purpose, as it takes actual work and experience to produce journeymen wiremen.

At the closing session, Harry Hilpert, electrical inspector, State of Washington, Seattle, was elected president. Other officers were: First vice-president, C. S. Alger, Puget Sound Power & Light Co., Seattle; second vice-president, R. J. Larrabee, Underwriters Laboratories, Seattle; secretary-treasurer, W. H. Gaffney, electrical inspector, Tacoma. The following were elected members of the executive committee: S. B. Clark, Northwestern Electric Co., Portland; W. T. Downie, Trumbull Electric & Mfg. Co., Seattle; A. J. Newton, chief state electrical inspector, Seattle; I. B. Sturges, electrical inspector, Portland; R. E. McDonough, The Montana Power Co., Butte; R. A. Walker, Puget Sound Power & Light Co., Seattle. Representatives on the Executive Council, IAEI were C. M. Kirsop and W. R. Volheye, while L. W. Going and W. H. Gaffney will represent the section as delegate and alternate on the electrical committee.

Recognition was given to Fred D. Weber, formerly electrical engineer with the Oregon Insurance Rating Bureau, Portland, who had served 19 years as secretary-treasurer and had recently retired to live at Pasadena. Weber's long service was acknowledged by resolution and the honorary membership accorded him by the International association, to be presented at the Santa Cruz convention of the Southwestern Section, was commended. E. B. Morrison, of Weber's organization in the Rating Bureau, who had carried on as secretary-treasurer pro tem in the interim between Weber's retirement and the meeting, reported a gain in membership for the year of 81 and a healthy financial condition for the Northwestern Section.

In the annual golf tournament, W. L. Gaffney carried off the honors.

NEL&PA Activities Increase

Northwest association considers program, names officers at recent annual meeting in Spokane

J. A. HALE, vice-president of the Utah Power & Light Co., was re-elected president of the Northwest Electric Light & Power Assn. at the 37th annual meeting in Spokane, July 26. C. Patrick Johnson, vice-president, Puget Sound Light & Power Co., was named vice-president, a position he will carry along with the continued chairmanship of the electrical development committee, new over-all planning committee of the association.

The meeting took recognition of increased activity during the past year along several lines. The inauguration of regional dealer meetings in June 1944, was pointed to as a step toward unifying the promotional activity of electrical industry in the Pacific Northwest for the postwar period. Many new dealer and contractor members of the association have resulted from this first series of ten meetings held in Washington, Oregon and Idaho.

Planning for the future had been undertaken in all three sections. A new classification of accounts committee had been appointed in the Accounting & Business Practice Section, under the chairmanship of T. W. Fryou, Portland General Electric Co., to study borderline cases of interpretation, in an endeavor to encourage uniform practices.

The planning committee of the Engineering & Operation Section, with J. M. Jones, Idaho Power Co., chairman, has under way a study of rural extension policies and present and prospective construction standards of member companies with a view to seeing whether the cost of rural line construction can be lowered. In the Utilization Section, under the chairmanship of C. E. Hess, Puget Sound Power & Light Co., chief new activity was the organizing of regional dealer meetings. At the same time, steps have been taken toward standardization of water heating practices looking toward the ultimate adoption of NEMA in water heater standards. The promotion of adequate wiring for the postwar period was heartily endorsed. A new industrial development committee has been organized in the section to coordinate, in so far as it is feasible, utility company industrial programs for the postwar era.

Another new activity was reported in the formation of a Personnel Conference with C. W. Sherman, Puget Sound Power & Light Co., as chairman. One conference had been held and six committees are now at work surveying member company practices on many phases of personnel work with a view to reporting at another conference this fall.

Other officers elected were: state vice-presidents, for Idaho, C. J. Strike, Idaho Power Co.; for Montana, Robert O. Kerr, The Montana Power Co.; for Oregon, T. E. Roach, Northwestern Electric Co.; for Utah, W. A. Huckins, Utah Power & Light Co.; for Washington, Daryl B. Leonard, Pacific Power & Light Co.; for British Columbia, W. C. Mainwaring, B. C. Electric Railway Co.; members at large of the executive committee, George E. Sullivan, Portland General Electric Co., R. G. Chamberlain, Hurley Machine Co., Seattle, and J. Irving Colwell, Graybar Electric Co., Seattle.

President Hale has appointed new section chairmen for the coming year as follows: Accounting & Business Practice, J. H. Rogers, Idaho Power Co.; Engineering & Operation, Harry M. Jones, Idaho Power Co.; Utilization, A. H. Wegner, The Washington Water Power Co. Berkeley Snow continues as executive secretary of the Northwest Association.

More Code Discussion

Priming themselves for the annual meeting of the Southwestern Section, being held in Santa Cruz Aug. 28, 29 and 30 (and too late for report in this issue), both the Northern California Chapter and Southern California Chapter of the International Association of Electrical Inspectors held an extra meeting on July 26. The northern California meeting was held at PG and E Auditorium, San Francisco, with Harry Romick, San Francisco electrical department, chairman, presiding. That in southern California was held at Huntington Park and presided over by I. E. Bartlett, Inglewood electrical inspector, chairman.

The Northern meeting had a pre-Code discussion of many questions which will be brought up in the discussion for revision of the National Electrical Code at Santa Cruz. These dealt particularly with motor installations, many inconsistencies having been found in previous editions of the Code. Likewise, divergence of rulings between the Code and the California State Safety Orders of the Industrial Accident Commission would indicate a need for uniformity.

Ben Hill, superintendent, Electrical Division, Oakland, showed the group a bed lamp using a fluorescent lamp of 14 watts which was equipped with a reactor winding on the lamp cord. This brought the cord temperature up to 100° C. and the lamp consumed 65 watts instead of 14. The danger of such trick devices was emphasized and the necessity for sales control ordinances brought out. There were 53 present at the meeting and discussion was lively.

The Southern California Chapter meeting, held all day long, had a wider range of subjects. Changes in the motor section of the Code were discussed. Other topics were the rewiring of old homes after the war, recent fires and accidents caused by misuse of equipment.

Leonard Hobbs, Smoot-Holman Co., told of a recent trip to Washington to attend a War Production Board conference on fluorescent lighting. Frank Appleton, field engineer, Spencer Thermostat Co., presented a talk on *Inherent Overheat Motor Protection*. F. V. Frey, inspector, Pasadena Light & Power Department, also spoke on the relationship of inspectors to the utility. The next two meetings were set as Nov. 22 at Pasadena and Jan. 31 at Laguna Beach.

● AT ITS THIRD MEETING the Electrical Maintenance Engineers Assn. in Portland adopted a constitution and elected officers to serve until February 1945. Those elected were C. P. Merklin, Norris, Beggs & Simpson, chairman; Gabriel Pascuzzi, vice-president; A. J. Flechsig, secretary-treasurer, and as directors A. F. Sall, L. E. Reeves and C. R. Mott.

Meetings of the organization are held on the fourth Thursday of the month, the next one to be on Sept. 28. The executive committee met in late July to appoint committees to head up finance, membership and programs for the year.

Portland EMEA is the latest organization of this kind to be formulated, there being active EMEAs in Los Angeles and San Francisco on the Pacific Coast and in many eastern cities. Membership is composed of men having to do with the maintenance of electrical and mechanical equipment in office buildings, factories, shipyards, Army posts and public buildings. The organizations are educational in nature, the purpose being to bring before the membership interesting programs dealing with electrical or mechanical equipment, its maintenance and characteristics of operation.

The *Stake* of the United States in Expanding World Trade

WITH the war in Europe racing to a climax, and with a sure pattern for the defeat of Japan already outlined, American business is confronted with the need for an immediate decision on long-term economic policy.

What is this country's foreign trade program to be after the war?

No intelligent appraisal of all the factors any longer can allow us to postpone considering the issue merely because, in the past, foreign trade absorbed barely eight per cent of our production.

Actually, a whole new set of conditions was injected into the picture by the first World War; but we persisted in ignoring these new factors.

Almost overnight, the United States was transformed from the largest debtor nation in the world to the second largest creditor nation. At the same time, we made faster technological progress than any other nation. Thus we created the need for more dollar exchange on the part of the rest of the world and simultaneously made it harder for other nations to earn dollars.

Today, as another, far vaster war is approaching its end, those changed circumstances are magnified. America has new responsibilities—to itself, and to the world.

Our war-inflated industrial capacity cannot be allowed to drop back to prewar levels without causing a domestic crisis which we dare not permit.

And, because so much of the world is geared to the American industrial machine, we can no longer contemplate calmly the repercussions of a largely self-sufficient trade program or of an unplanned foreign trade program. Either would inevitably set the stage for the next world war.

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If we are going to prepare ourselves intelligently to cope with this new problem, we must acknowledge certain basic principles.

World trade cannot be rebuilt simply by attempting to restore *prewar* flows of goods. The war has so completely changed the economic fiber of many countries that it is necessary to develop *new* trade relationships. The East Indies, for example, may find the demand for their rubber considerably reduced; the United States may, to a large extent, have to cease exporting cotton; Japan will need to find new substitutes for much of its exports of silk; the British will need new markets to replace the income which they formerly derived from their large overseas investments.

We cannot expand markets for our goods, at home or abroad, unless we find ways of buying more supplies from more people at home or abroad, so that they will have more dollars to spend.

And we probably cannot create increasing buying power abroad without first exporting more of our technical skills—our engineers, our production and management men—to build new markets for our own specialties.

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What is needed to rebuild the world's economic system?

1. Most basic of all, of course, are stable governments which command popular support. In the absence of strong governments, currency stability cannot be achieved.

2. Most war-stricken countries, for a year or two, will need rehabilitation loans, because they will require far more raw materials, equipment, and live stock than they can pay for out of current production.

3. Loans, however, are only a stop-gap, though often a necessary one. Far more important than rehabilitation loans will be the creation of better opportunities for war-stricken countries to sell to the rest of the world, particularly to the United States, South America, South Africa, and India. The ravages of war do not completely destroy the ability of a country to sell. Indeed, it is surprising what large supplies of certain commodities war-torn countries have on hand even before devastated industries have been restored. The invading troops in Normandy found shoes almost non-existent, but they found food more plentiful than in Britain.

   Better opportunities for war-stricken countries to sell would create opportunities for them to buy the things they will require to restore scattered industries and depleted farms, and would help those countries to get rid of the exchange controls which are now universal. So long as a country is able to expand its exports only slowly and painfully, and is dependent upon foreign loans to prevent the depreciation of its currency, so long will it carefully preserve exchange controls and other restrictions in imports. That is why large advances, either through an International Monetary Fund or an International Investment Bank, can make only limited contribution to the removal of trade restrictions.

4. Permanent monetary and credit arrangements are needed to protect nations against temporary pressure upon their currencies, to permit necessary changes in exchange rates to be made in an orderly manner, and to assure that governments never again will repeat the "beggar-my-neighbor" policies of 1931 and 1932.

5. Finally, the world needs a reversal of the trend toward economic self-sufficiency, which received a strong impetus from the first World War and an even stronger one from the great depression of the Thirties. This does not mean that the efforts of many raw-material producing countries to diversify their industries should be opposed. During the late Nineteenth Century and the first part of

this century, the international specialization of production was carried too far, with the result that many countries became dependent for a large part of their standard of living upon the export of one or two raw materials—coffee, sugar, rubber, silk, wheat, wool, and meat. Between the two World Wars, however, the pendulum swung much too far in the direction of self-sufficiency. Some densely populated industrial countries of Europe (Italy, France, and Germany) even attempted to become self-sufficient in wheat, fats, and sugar. So limited are the natural resources and technical skills of most countries that each one finds many things which it can produce only at prohibitive costs. Between the extreme specialization of the late Nineteenth Century and the more recent trend toward extreme self-sufficiency, a happy medium should be sought.

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What role should the United States play in reconstructing the world's international economic system?

There are those who suggest that the United States be a more or less permanent Santa Claus. They believe that an excess of exports could be financed only by "loans"—loans that would eventually turn into gifts, after producing bitter controversy over why the "debtor" country did not meet its obligations. The persons who assert that full employment can be provided only by an excess of exports are in effect saying that our economy cannot become self-supporting. That is a confession of economic defeatism which a young and vigorous nation should not be willing to make.

The most immediate contribution which the United States can make to world reconstruction is to make itself prosperous.

Prosperity here means a large demand by our industries for imports. The more we import, the easier will it be for foreign countries to meet their large and urgent needs for goods. In 1939, with a gross national product of $100 billion, our imports were $3 billion. After the war, with 55 million people employed and a gross national product of $155 billion, our imports would be about $7 billion or $8 billion.

Not only should the United States make itself prosperous, but it should *keep* itself prosperous. *So important is the United States in the world economy that a depression here is bound to produce a disastrous drop in the price of raw materials throughout the world and to throw most countries into an economic tailspin.*

The United States should support the principle of a large fund to protect the exchanges of the world from temporary pressure. We should not permit differences over the details to prevent its establishment in ample time to be available during the critical period when war-stricken countries will need goods far in excess of their immediate ability to pay for them. *Some* arrangement, even though imperfect in details, will be infinitely superior to no arrangement.

Finally, the United States should take the lead in breaking down barriers to trade. We are the logical country to do this, partly because of our immense domestic market, and partly because for most of the last twenty-five years this country has been able to sell other countries more goods than they have been able to sell to us. One of the greatest contributions which the United States could make to a sound and expanding world economy would be to bring our imports, as soon as practicable, up to our exports. *In other words, the United States, in the long run, should be hard to borrow from but easy to sell to.* The United States should implement this policy (1) by continuing the negotiation of reciprocal reductions in duty, and (2) by accepting exchange rates which make foreign currencies cheaper in dollars than they were in 1939. So great will be the world's need for goods that we can be sure that any dollar exchange earned by sales to us will be converted into American-made goods and will lead to larger exports.

Time was when the United States obtained about eight per cent of its standard of living by sending goods abroad and bringing back other goods. Before the war, however, we were getting less than five per cent of our living by international trade. If, after the war, we were gradually to raise the proportion of our standard of living obtained by trading with other countries to ten per cent of domestic production, our imports would be about $15 billion or $16 billion a year. Our people would be able to buy many things which they now cannot afford, and scores of countries which export raw materials and luxury products would feel the stimulus of rapidly expanding markets. Their expanded demand for road building machinery, mining machinery, machine tools, agricultural implements, locomotives, railroad cars, electrical equipment, trucks, automobiles, and a multitude of products of our factories would create a million or more additional jobs in our factories.

Although the United States would raise its standard of living by increasing its imports and its exports, it should honestly face the fact that the resulting shifts in production and employment would temporarily be painful for some people. The increase in imports would be in commodities which other countries can produce for less than the cost at which much of our output is produced—such as sugar, wool, copper, some fats and oils, wines, winter vegetables and fruits. The increase in our exports would come from those industries in which our superiority is greatest—particularly the manufacturing industries. Finally it would be advantageous, to the country as a whole, to shift a million or two workers from agriculture, where they earn about 60 cents an hour at best, to manufacturing, where they earn better than 80 cents an hour.

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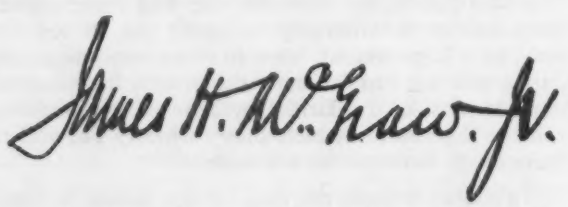
The very fact that in economic matters the rest of the world is dependent upon the United States, exposes our country to great demands and to envy and misunderstanding. The United States must be willing to help the rest of the world, but its help should take the form of assisting other countries to help themselves. Never in all history has one country had such an opportunity to give the world a rising standard of living, to foster conditions under which peace flourishes. What greater tragedy could there be than to make the sacrifices which we are now making and fail to seize this chance to create a world of hope and opportunity in which the spirit of goodwill among nations is able to flourish.



President McGraw-Hill Publishing Company, Inc.

Large Farm Market in Store for West

Studies indicate extent of rural electrification market in eleven Western states during war and postwar transition periods

EXTENT of the postwar rural electrification market — one of the bright spots on the electrical horizon—has been estimated by *Country Gentleman* magazine on the basis of studies conducted by state committees working under the auspices of the U. S. Department of Agriculture. For the eleven Western states a potential program involving the following totals is predicted:

Total expenditures	$296,580,000
Total miles of line	168,235
Farmstead wiring	44,819,000
Farm and home equipment	70,020,000

The study, which is presented in a booklet entitled *Rural Electrification —a Postwar Market Forecast*, estimated that between 10 and 20% of the expenditures will be consummated in the immediate war and postwar transition periods. The following tables and extracts from the study will give a comprehensive picture of the rural market in the Far West.

"Many months ago the U. S. Department of Agriculture formed an Inter-Bureau Postwar Planning Committee consisting of responsible bureau and agency heads within the department. It was the primary task of this committee to develop and coordinate broad plans for postwar agriculture in the United States and lay the groundwork for the ultimate execution of those plans. To assist this committee, regional committees were also formed composed largely of representatives from various field offices of the department and staff members of state agricultural or land grant colleges. Under the guidance and advice of these regional committees, each state was asked to appoint a state committee to study its own postwar agricultural problems and submit a report of the findings, together with recommended programs for their solution. The membership of these state committees represented a broad cross section of groups interested in and thoroughly familiar with agricultural and rural conditions and needs in the respective states.

"Among the principal topics covered in the state reports was rural electrification. Most of the states even went so far as to outline a recommended program for its postwar development and submitted estimates of the potential market if the program was carried out. For the most part, these programs and estimates appear to represent the consensus of opinion of consumers, private power interests, agricultural educators, rural electric cooperatives and various governmental agencies, including the Rural Electrification Administration.

"It must be emphasized at the outset that all data contained in the state reports are *estimates* of tentative rural electrification programs; as such they are indicative of *preliminary thinking* by the various state committees and will probably be supplemented by more detailed study and planning, a possibility which was mentioned in several of the reports. If and when any of the state reports are revised, it is contemplated that these tables will be adjusted accordingly. The fact that the material is purely an estimate should not detract from its value if considered in the light of what might be, rather than what will be. For the most part, the respective state programs were prepared and predicated on the *assumption* that most of the future developments in rural electrification will employ the principle of area coverage. Under this principle an effort is made to bring electric service, as economically as possible, to substantially every rural consumer in a given area whose boundaries are largely determined by economic and geographic factors. It is believed, and experience apparently proves, that area coverage permits greater utilization of mass production methods with resultant lower construction and distribution costs for all consumers.

"Theoretically perhaps, every rural establishment is a potential consumer of electricity. Practically, however, this is far from the fact. In certain areas consumer density may be so thin, establishment so isolated, or income and purchasing power so low, that the ultimate cost of electrification to the consumer would be prohibitive and probably could never be made to pay. In order to arrive at the number of potential consumers upon which the estimated programs are based, nearly

Table 1—Status of Rural Electrification—As of January 1, 1944

Region & State	Number of Farms*	Number of Farms Connected to Power Lines**	% Total Farms Connected to Power Lines	Home Elec. Plants on Farms*	Total Elec. Farms	% Total Farms Elec.	Total Rural Non-Farm Dwell. Units*	Rural Non-Farm Wired Homes‡	% Total Rural Non-Farm Dwell. Units Elec.
Mountain	**233,497**	**106,586**	**45.6**	**14,367**	**120,953**	**51.8**	**393,861**	**250,105**	**63.5**
Montana	41,823	10,741	25.7	3,741	14,482	34.6	56,301	32,141	57.1
Idaho	43,663	32,682	74.9	945	33,627	77.0	45,934	32,862	71.5
Wyoming	15,018	5,098	33.9	1,710	6,808	45.3	25,265	14,577	57.5
Colorado	51,436	23,199	45.1	4,912	28,111	54.7	96,208	59,204	61.5
New Mexico	34,105	6,207	18.2	2,075	8,282	24.3	50,166	19,106	38.1
Arizona	18,468	7,051	38.2	424	7,475	40.5	62,038	41,832	67.4
Utah	25,411	19,868	78.2	303	20,171	79.4	39,763	38,270	96.2
Nevada	3,573	1,740	48.7	257	1,997	55.9	18,086	12,113	67.0
Pacific	**276,173**	**241,564**	**87.5**	**5,550**	**247,114**	**89.5**	**738,550**	**621,885**	**84.2**
Washington	81,686	68,426	83.8	1,799	70,225	86.0	165,746	140,086	84.5
Oregon	61,829	45,326	73.3	1,641	46,967	76.0	104,744	75,239	71.8
California	132,658	127,812	96.3	2,110	129,922	97.9	468,060	406,560	86.9
Total 11 Western States	509,670	348,150	68.3	19,917	368,067	72.1	1,132,411	871,990	77.1
TOTAL U. S.	6,096,799	2,556,212	41.9	179,067	2,735,279	44.9	8,066,837	5,923,012	73.4

Sources: * U. S. Census—April 1, 1940.
** As of Jan. 1, 1944—Edison Electric Institute (preliminary figures).
‡ As of Jan. 1, 1944—Based on data from Edison Electric Institute and U. S. Bureau of Census.

Table 2—Estimated Number of Potential Consumers—By Regions and States

Region & State	Between Now and End of War	Transition Period	Total War and Trans. Period	Long-Time Postwar Period	Grand Total	Additional Customers That Might Be Served Under Broadened Standards of Feasibility
Mountain	**3,196**	**28,682**	**31,878**	**168,108**	**199,986**	**76,643**
Montana	310	6,010	6,320	33,390	39,710	8,290
Idaho	326	3,164	3,490	18,875	22,365	5,592
Wyoming	350	5,879	6,229	6,518	12,747	6,534
Colorado	1,700	9,140	10,840	42,500	53,340	11,000
New Mexico	250	1,809	2,059	31,000	33,059	30,000
Arizona	35	1,018	1,053	25,396	26,449	13,000
Utah	150	1,242	1,392	4,863	6,255	1,400
Nevada	75	420	495	5,566	6,061	827
Pacific	**1,695**	**13,561**	**15,256**	**150,608**	**165,864**	**20,680**
Washington	980	6,420	7,400	36,570	43,970	6,500
Oregon	640	5,955	6,595	33,680	40,275	6,180
California	75	1,186	1,261	80,358	81,619	8,000
Total 11 Western States	4,891	42,243	47,134	318,716	365,850	97,323
TOTAL U. S.	132,144	442,122	574,266	4,557,217	5,131,483	1,373,446

Source: State Postwar Planning Reports, February-March 1944.

Table 3—Estimate of Total Costs and Expenditures—By Regions and States

Region & State	Between Now & End of War	Transition Period	Total War & Trans. Period	Long-time Postwar Period	Grand Total
Mountain	**$1,927,000**	**$26,344,000**	**28,271,000**	**$136,233,000**	**$164,504,000**
Montana	148,000	5,715,000	5,863,000	26,712,000	32,575,000**
Idaho	194,000	3,171,000	3,365,000	14,798,000	18,163,000**
Wyoming	110,000	4,694,000	4,804,000	5,599,000	10,403,000
Colorado	1,292,000	8,733,000	10,025,000	33,873,000	43,898,000
New Mexico	60,000	1,888,000	1,948,000	26,575,000	28,523,000
Arizona	8,000	764,000	772,000	22,071,000	22,843,000
Utah	76,000	1,058,000	1,134,000	3,062,000	4,196,000
Nevada	39,000	321,000	360,000	3,543,000	3,903,000
Pacific	**1,171,000**	**13,665,000**	**14,836,000**	**117,240,000**	**132,076,000**
Washington	629,000	7,196,000	7,825,000	30,808,000	38,633,000**
Oregon	502,000	4,929,000	5,431,000	25,814,000	31,245,000**
California	40,000	1,540,000	1,580,000	60,618,000	62,198,000
Total 11 Western States	3,098,000	40,009,000	43,107,000	253,473,000	296,580,000
TOTAL U. S.	72,648,000	429,004,000	501,652,000	3,000,820,000	3,502,472,000

**Not given in State Report. Based on estimates of Rural Electrification Administration.
Source: State Postwar Planning Reports, February-March 1944.

Table 4—Estimate of New Line Construction—By Regions and States

Region & State	Between Now and End of War		Transition Period		Total War and Transition Period		Long-time Postwar Period		Grand Total	
	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost
Mountain	**1,330**	**$1,390,000**	**9,463**	**$10,928,000**	**10,793**	**$12,318,000**	**94,567**	**$74,243,000**	**105,360**	**$86,561,000**
Montana	76	95,000	2,112	2,515,000	2,188	2,610,000	13,356	13,356,000	15,544	15,966,000*
Idaho	110	138,000	950	1,234,000	1,060	1,372,000	7,864	7,864,000	8,924	9,236,000*
Wyoming	50	50,000	2,103	2,269,000	2,153	2,319,000	2,834	2,395,000	4,987	4,714,000
Colorado	1,000	1,000,000	3,040	3,303,000	4,040	4,303,000	21,500	18,168,000	25,540	22,471,000
New Mexico	14	24,000	525	890,000	539	914,000	24,346	15,825,000	24,885	16,739,000
Arizona	..	3,000	305	260,000	305	263,000	21,163	13,756,000	21,468	14,019,000
Utah	60	54,000	406	348,000	466	402,000	2,000	1,300,000	2,466	1,702,000
Nevada	20	26,000	22	109,000	42	135,000	1,504	1,579,000	1,546*	1,714,000
Pacific	**661**	**828,000**	**4,805**	**5,322,000**	**5,466**	**6,150,000**	**57,409**	**63,149,000**	**62,875**	**69,299,000**
Washington	327	409,000	2,590	2,869,000	2,917	3,278,000	15,240	15,240,000	18,157*	18,518,000*
Oregon	314	392,000	1,850	1,901,000	2,164	2,293,000	13,470	13,470,000	15,634*	15,763,000*
California	20	27,000	365	552,000	385	579,000	28,699	34,439,000	29,084	35,018,000
Total 11 Western States	1,991	2,218,000	14,268	16,250,000	16,259	18,468,000	151,976	137,392,000	168,235	155,860,000
TOTAL U. S.	43,985	45,927,000	113,032	117,451,000	157,017	163,378,000	1,594,735	1,426,937,000	1,751,752	1,590,315,000

**Not given in State Report. Based on estimates of Rural Electrification Administration.
Source: State Postwar Planning Reports, February-March 1944.

Table 5—Estimate of Farmstead Wiring—By Regions and States

Region & State	Between Now & End of War	Transition Period	Total War & Trans. Period	Long-time Postwar Period	Grand Total
Mountain	**$310,000**	**$3,577,000**	**$3,887,000**	**$19,058,000**	**$22,945,000**
Montana	31,000	759,000	790,000	4,174,000	4,964,000*
Idaho	33,000	403,000	436,000	2,359,000	2,795,000*
Wyoming	35,000	743,000	778,000	815,000	1,593,000
Colorado	170,000	1,198,000	1,368,000	5,312,000	6,680,000
New Mexico	19,000	187,000	206,000	3,100,000	3,306,000
Arizona	3,000	103,000	106,000	2,116,000	2,222,000
Utah	11,000	130,000	141,000	486,000	627,000
Nevada	8,000	54,000	62,000	696,000	758,000
Pacific	**195,000**	**1,938,000**	**2,133,000**	**19,741,000**	**21,874,000**
Washington	123,000	1,012,000	1,135,000	5,486,000	6,621,000*
Oregon	64,000	776,000	840,000	4,210,000	5,050,000*
California	8,000	150,000	158,000	10,045,000	10,203,000
Total 11 Western States	505,000	5,515,000	6,020,000	38,799,000	**44,819,000**
TOTAL U. S.	14,548,000	60,026,000	74,574,000	496,815,000	**571,389,000**

*Not given in State Report. Estimates of Rural Electrification Administration used.
Source: State Postwar Planning Reports, February-March 1944.

all of the states took into consideration, or established for themselves, certain yardsticks or "standards of feasibility." These standards of feasibility are applied to determine whether an electrification program in a given area can be put on a self-sustaining and self-liquidating basis. The factors used in establishing these feasibility standards are fairly uniform in character and are employed by recognized leaders in the field of rural electrification. They include such items as the following:

1. Regional land-use plans.
2. Character of land and farming.
3. Farm values, acreage and income.
4. Farm ownership.
5. Population trends.
6. Ownership of equipment and facilities.
7. General credit rating.
8. Consumer attitude toward electrification.
9. State regulations and regulatory bodies.
10. Consumer potential.
11. Cost per mile per consumer for construction.
12. Energy sources.
13. Estimated revenues and operating costs.
14. Legal aspects.

"While the above list does not cover all the detailed points considered in determining feasibility, it does indicate, sufficiently, the type of thoroughgoing analysis used in judging whether the development of rural electrification is practical in a specific area.

"One of the most interesting and significant features of the estimates is their breakdown into three major periods as follows: (1) Between now and the end of the war, (2) Transition period, (3) Long-time postwar period. This identical breakdown has been shown in all tables of estimated programs and is important because it gives a reasonably accurate clue to the relative timing of the various program phases.

"That portion of the estimates assigned to the first period, i.e., between now and the end of the war, represents potential rural connections that have either been authorized or would qualify under existing War Production Board regulations. The portion shown for the second or transition period includes developments already begun but now frozen by stop orders; applications for extension of rural service not yet started; and potential connections along existing lines. This is the part of the program which is currently suspended but can be expected to get under way when restrictions are lifted and when materials, labor and equipment become available.

"In each of the main Tables 2 to 7, inclusive, we have shown a summary column combining the first and second periods. The purpose of this is to segregate that part of the whole program which is ready to go as distinguished from that in the more distant future. The portion of the estimates assigned to the third or long-time postwar period represents the bulk of the program and is generally understood to cover anywhere from five to fifteen years after the war. This phase may be accelerated, however, depending upon the amount of preliminary work and planning that is done during the present war emergency and the degree of market stimulation after the war.

"The estimated total cost of these programs is further broken down into several component tables and charts to show: (a) Line construction, (b) farmstead wiring, (c) expenditures for farm and home equipment, and (d) plumbing expenditures. (Ed. note—Plumbing expenditures are not shown in this summary).

"Table 1 shows the status of rural electrification, in terms of electrified farms and rural non-farm dwelling units on Jan. 1, 1944, by regions and states.

"The data in Table 2 comprise the nucleus and foundation for the respective state programs. Practically all figures of estimated costs and expenditures are related to these consumer potentials. Consumers, in the sense here used, include farmsteads, rural non-farm dwelling units and rural non-farm commercial and non-commercial establishments.

"Table 3 is a summary of the data contained in Tables 4, 5, 6 and 7.

"Table 4 shows the number of miles of line required to carry out the entire estimated electrification program, if the principle of area coverage is adhered to, and the estimated cost of building these lines. The figures do not include any costs for generating and transmission facilities but provide for organization, engineering and legal expenses and an allowance for contingencies. Provision has also been made for the cost of connecting potential consumers along existing lines.

"Table 5 is in reality an estimate of the cost of wiring all potential consumers covered by the program, including an allowance for additional wiring in the transition period, although the state reports designated it as 'farmstead wiring' and this title has been used. A test check shows, however, that it includes all potential consumers under the program.

"Data in Table 6 cover initial equipment and appliance purchases which new consumers are expected to make during the first 18 months of electric service connection and those which present consumers will make in a similar period of time. Little or no consideration is given to the equipment of additional purchases over a longer period, although some provision has been made in the long-time postwar period for purchases which new consumers, connected in the transition period, are expected to make."

Table 6—Estimate of Farm and Home Equipment Expenditures—By Regions and States

Region & State	Between Now & End of War	Transition Period	Total War & Trans. Period	Long-time Postwar Period	Grand Total
Mountain	$229,000	$8,215,000	$8,444,000	$31,355,000	$39,799,000
Montana	22,000	1,725,000	1,747,000	6,915,000	8,662,000**
Idaho	23,000	991,000	1,014,000	3,299,000	4,313,000**
Wyoming	25,000	1,337,000	1,362,000	1,744,000	3,106,000
Colorado	122,000	2,864,000	2,986,000	7,559,000	10,545,000
New Mexico	18,000	542,000	560,000	5,568,000	6,128,000
Arizona	3,000	273,000	276,000	4,519,000	4,795,000
Utah	11,000	385,000	396,000	881,000	1,277,000
Nevada	5,000	98,000	103,000	870,000	973,000
Pacific	149,000	4,476,000	4,625,000	25,606,000	30,231,000
Washington	98,000	2,471,000	2,569,000	7,614,000	10,183,000**
Oregon	46,000	1,527,000	1,573,000	5,850,000	7,423,000**
California	5,000	478,000	483,000	12,142,000	12,625,000
Total 11 Western States	378,000	12,691,000	13,069,000	56,961,000	70,030,000
			184,935,000	775,251,000	960,186,000
TOTAL U. S.	12,179,000	172,756,000			

*Includes farm equipment only.
**Not given in State Report. Based on estimates of Rural Electrification Administration used.
Source: State Postwar Planning Reports, February-March 1944.

ELECTRICAL WEST

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Irrigation Gets "Overpowered"

WHEN Congressman Ben F. Jensen of Iowa once suggested that the Commissioner of the Bureau of Reclamation might have been "overpowered" in neglecting the irrigation features of the Central Valley project, he did not know that his *double entendre* voiced a suspicion long harbored by California farmers. Here is the way Congressman Jensen put the thought during hearings on the Interior Department appropriation bill early this year in questioning Commissioner Bashore: "Has somebody got so much power and is so interested in power that they have overpowered you to the point where you cannot get any water on this project?" Naturally this brought forth a negative answer.

However, the suspicion still prevails, not only as regards the Central Valley but Grand Coulee and other USBR undertakings where early emphasis was on irrigation and present activities hinge solely around power. In fact, on neither of these projects has there been any announcement of a rate for irrigation water, although the whole program of land settlement and crop economy will depend upon this charge. There are some who feel that no economical water rate can be formulated which, when combined with power revenues, will return a sufficient amount to make either project self-liquidating. Certainly with present attention confined largely to power development and to "cheap power" as well, it does not seem possible that the intended power by-product can materially decrease the future water rates. It is a well known fact that revenue from water alone would never be sufficient to pay for either project.

Many Westerners who know that basically water is of more value to Western agriculture for irrigation than it is for power generation, have long felt that the power tail has been wagging the irrigation dog in the Reclamation Bureau. The fact that $140,000,000 has been spent on Central Valley and $160,000,000 on Grand Coulee without putting an acre-foot of water on an acre of land seems to sustain this belief.

Good Street Lighting

WERE you ever awakened late at night out of a sound sleep by a sickening crash followed by a chilling silence? "An accident on that dark corner," you think. Minutes later—it seems like hours—there is the billowing howl of an ambulance siren. Did you ever have to reason with an hysterical woman, the wife of a neighbor perhaps, who had been accosted in the middle of a dark block by a strange man? Maybe she ran into your house as the nearest escape. Did you ever tramp down hard on the brakes on a rainy night as you drove into a poorly lighted intersection when a couple of dark clothed people loomed up in your inadequate headlights? "My God, what if I had hit them?" you think.

If you have had any of these experiences, then as an electrical man or woman, you appreciate the benefits of good street lighting. Except that there have been few people in the industry who do, and fewer still who have done anything about it. Now things promise to be different. Beginning in August, the Street and Traffic Safety Lighting Bureau, a promotional agency of NEMA, started a national campaign aimed at convincing municipal officials that adequate street lighting should be a definite part of their postwar plans. The campaign gun, however, has another barrel, equally important. It is aimed at convincing electrical people, and utilities in particular, that good street lighting will produce tangible benefits to this group.

Sponsors of the campaign point out that utilities will profit three ways from the program: (1) Through improved public relations; (2) increased load and revenue; and (3) facility in securing adequate funds for maintaining and servicing good street lighting. There is another benefit even more important, namely, the satisfaction of discharging a civic responsibility in helping to save lives, protect property and prevent crime.

Here is one program that deserves to succeed. With proper industry backing, it will.

Referendum No. 25

REFERENDUM 25, the so-called Super-PUD measure, on which Washington voters will express a preference in November, has many significant aspects. One is the antagonism against the proposal which has been aroused in the ranks of labor. For many years union labor has been a proponent of public ownership. However, experience with many public power projects has given labor a new viewpoint. Dave Beck, Washington labor leader, recently told the Teamsters' Western Conference that "experiences in Nebraska and the Imperial Valley proved that labor suffers under socialization."

Another noteworthy aspect of No. 25 is the apparent unwillingness of public power proponents to take the issue to the people. Initiative No. 12 (No. 25 in its original form) was rushed through a favorable state legislature as an emergency measure rather than chance defeat in a popular election. The proposed law itself totally ignores the voters. It leaves to boards of PUD directors the absolute and final power in determining the size of a district, in levying rates and providing service and finally in voting securities. The public would have no voice in the supervision of monopolistic agencies with absolute powers. No satisfactory explanation has been advanced as to why the proponents, who masquerade as public benefactors, should fear the public's vote.

Outcome of the November vote on this measure may well establish a new era for Northwest utilities. Defeat of No. 25 might be considered as a vote of confidence to a group of utilities which, despite threats and badgering, have provided a high standard of service at ever-decreasing rates in the face of mounting tax burdens which their publicly owned competitors have been able to ignore.

Who Pays for the War?

EFFORTS of regulatory commissions to force utility companies to reduce rates so that a substantial part of so-called excess profits taxes will be returned to customers are both untimely and contrary to public interest. Furthermore, the contention of the California commission that such federal taxes should be disallowed as an operating expense is in defiance of sound rate-making theory and contrary to most interpretations of the laws regulating utility operations.

The assumption that the utilities are profiting unduly because of the war is based upon an apparent misconception of the unfortunate term "excess profits tax" selected by the Treasury Department to apply to this source of war tax revenues. The term is a misnomer. In the revenue law, it is used to designate a portion of income which is to be subjected to additional taxes to support the war effort. Its purpose is to assure that no industrial organization profits excessively as a result of the war. In the case of utilities, if profits were excessive, and hence rates subject to study and possible reduction, then stockholders would be benefiting. As a matter of fact, the net remaining for security holders after taxes is considerably smaller today than in 1939 for practically all companies. Furthermore, there are some which are penalized to such an extent that net earnings fall short of what might be considered a fair return.

It appears obvious that any reduction of utility rates which would result in wiping out all or part of that portion of utility income on which war taxes are now levied, would hamper the government's war financing. If the theory were to be applied nationally, the loss in tax revenues might reach a billion dollars. The so-called excess profits tax was devised to return to the government the greater part of the extraordinary gains received by industry due to the nation's war effort. Taking such gains for rate reductions certainly would interfere seriously with this purpose. No real gains would accrue to the public, because if federal revenue from war taxes declines in one place, the people would have to make up the deficit. Furthermore, irreparable damage might be done to the utilities by impairing their ability to cope with postwar problems or to contribute to postwar employment.

If the process is to be enforced, the most obvious course is to make any reductions temporary. This has been done in some instances. Even so, revenues vital to the conduct of the war are lost.

WITH the mounting tax burdens there appears to be a growing feeling that public power should be taxed in the same way and to the same extent as is private enterprise. The reason for this is that every time government enters into competition with private enterprise, it kills off a real source of public revenue, the effect of which is to add to the taxes of those who are not tax exempt. It is realized that in one way or another, through added costs to the goods and services they buy and levies on their income, property and savings, it is the people who pay the taxes, and they naturally want the burden spread around as much as possible. Failure of government to put itself on an equal footing with private enterprise in its proprietary activities undermines democracy, does not fundamentally enhance the public welfare, and is not only unjust but harmful to those who have put their savings in private enterprise.—Frank McLaughlin, president, Puget Sound Power & Light Company.

KEEP OUR POST-WAR EYE ON THESE MONARCH FIRSTS

XCLUSIVE FEATURES will com-
and as much consumer attention
fter the war as before. In fact,
Mrs. Consumer will be *more con-*
cious than ever about new fea-
ures of convenience and operat-
ng efficiency. All of which will
lay right into the hands of
Monarch Electric Range dealers—
ecause Monarch *will have* these
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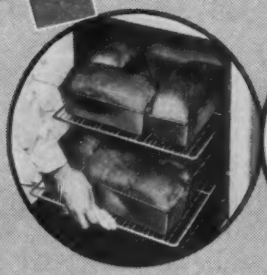
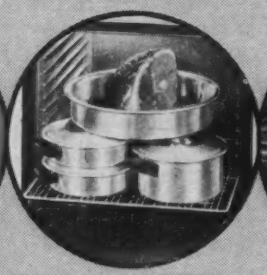
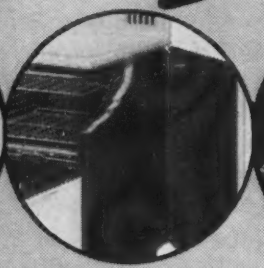


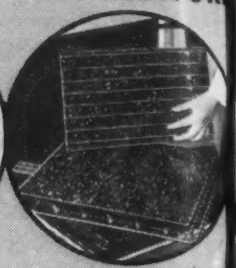
Large Capacity—holds 8 standard, 1-lb. loaves of bread.



Automatically operated interior light.

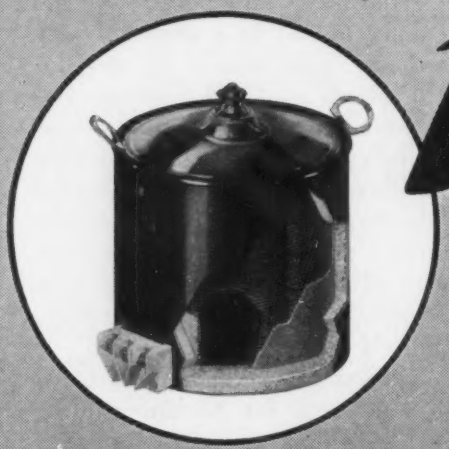


5-wall design with removable porcelain armor.



All interior parts removable for easy cleaning.

1ST OVEN WITH THESE FEATURES



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Side application of hea
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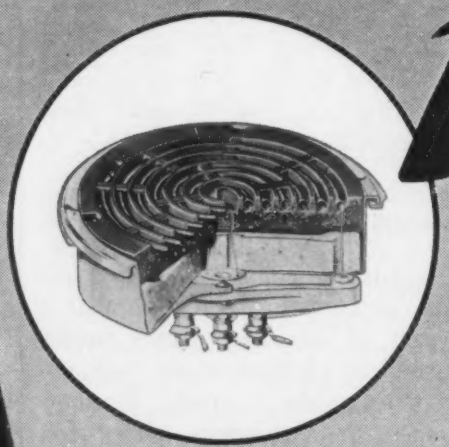
produces peak cookin
efficiency in a "surfac
oven." Saves electricit



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Thick insulating blo
underneath unit pr
vents downward hea
loss, stores heat,
electric bills.

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IT'S A
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built-in, cooking-top
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O BALANCE OUT your post-war electrical appli-ce line, you'll want to include Electric Water eaters — because there is plenty of evidence to dicate that the Electric Water Heater market ll be big.

nd, in making your choice, you can do yourself better turn than to select MONARCH — a line at is totally proven, firmly established, backed 15 years of manufacturing know-how, and pularized by a trade mark that has stood for ality for over three generations.

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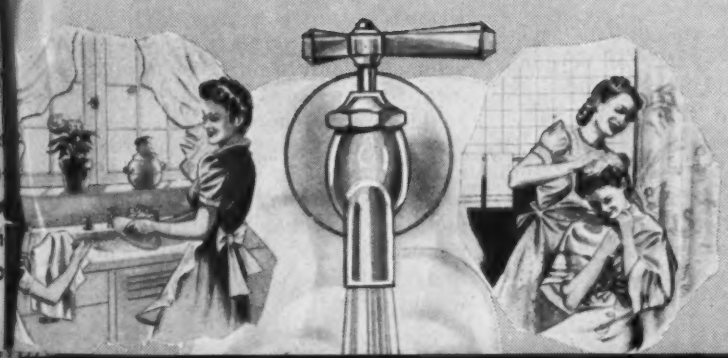

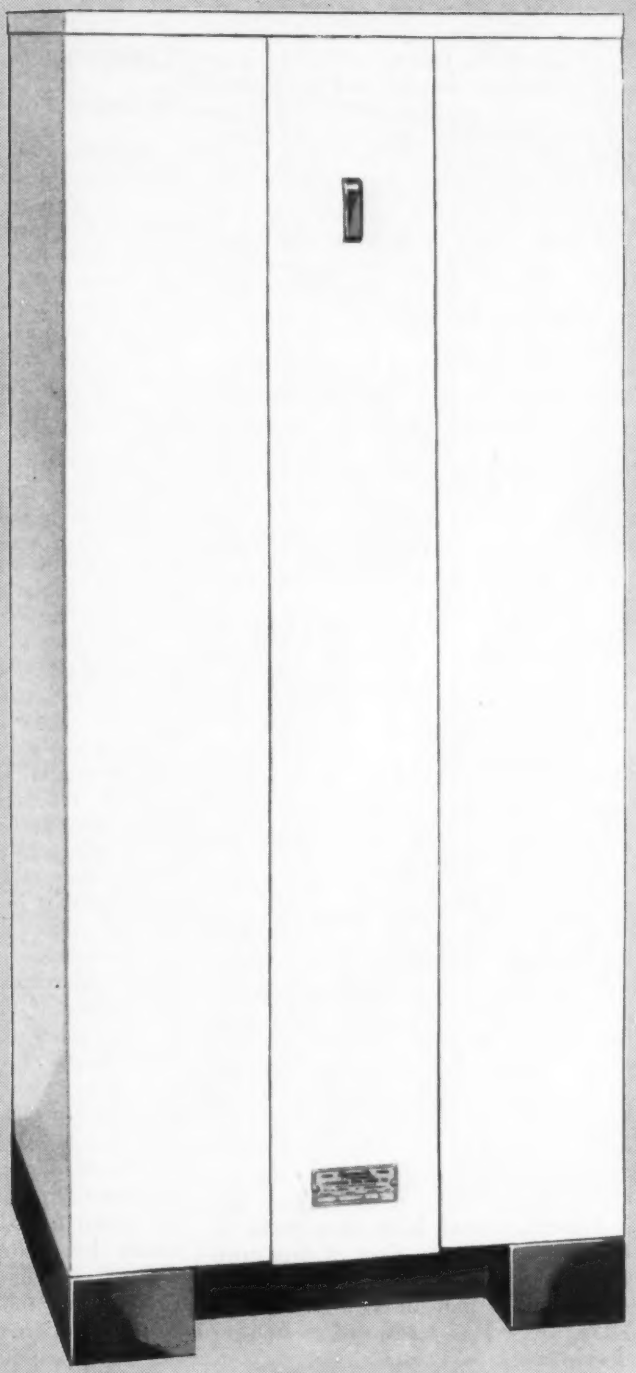

KEEP THE ENTIRE FAMILY IN HOT WATER

NEWS of the industry

ARIZONA, USBR STUDY POWER DEVELOPMENT

Approximately 2,000,000 acre-ft. of Colorado River water may be diverted into central Arizona, as the result of actions taken by the state and the U. S. Bureau of Reclamation during the past two months. Potential power development is 12,000,000,000 kwh. annually.

A contract has been signed by Arizona's Governor Sidney P. Osborn and H. W. Bashore, Bureau of Reclamation chief, making the state and the bureau partners in a preliminary survey of the development, estimated to cost $640,000,000.

Under the terms of the contract, R. Gail Baker, former superintendent of the Salt River Valley Water Users Assn. and one-time city engineer of Phoenix, was chosen project engineer to represent the state on all reclamation studies.

A joint survey will be made in the near future by state and bureau engineers to determine the most feasible of three proposed projects. The projects were selected after data was assembled by a U. S. Senate subcommittee on irrigation and reclamation, including Ernest W. McFarland, Arizona; Charles A. Hatch, New Mexico, and Chan Gurney, South Dakota.

These projects, as described by E. B. Debler of Denver, director of project planning for the Reclamation Bureau, with comparative costs and production figures for each, are:

1. A high dam in Marble Gorge 36½ miles below Lee's Ferry, and above Grand Canyon National Park; a 139-mile tunnel to a point on the Verde River near Camp Verde, and a series of dams along the Verde for stream regulation and power development. Cost of the project, exclusive of the cost of Marble Gorge Dam, which the Reclamation Bureau plans to build for power development anyway, was estimated at about $487,000,000.

2. A high dam at Bridge Canyon at the head of Lake Mead, a 72-mile tunnel to Sacramento wash, an 82-mile tunnel from Sacramento wash to the 400,000-acre-ft. reservoir site on Cunningham wash, near Parker, and a 180-mile canal from that point to Granite Reef Dam. Cost of this project was fixed at about $325,000,000, exclusive of that of Bridge Canyon Dam, which is also planned as a power development.

3. A pumping plant on Lake Havasu to lift the water 1,040 ft. into a canal that would carry it to the Cunningham reservoir site, then a 180-mile canal to Granite Reef. This project would cost in the neighborhood of $134,000,000.

Describing the merits of the three projects, Debler said that power generated by the Marble Gorge development would be worth about $28,450,000 annually; that of the Bridge Canyon project about $23,875,000 a year, and that of the Lake Havasu project about $22,235,000.

Commissions Continue Columbia Power Survey

Potential water power of the Columbia River apparently is inexhaustible, according to members of a joint Canadian and United States river commission, which recently completed a 2,000-mile tour of the Columbia basin, as the first step in a survey which is expected to take several years to complete.

Headed by A. O. Stanley, former governor and senator of Kentucky, and Roger McWhorter, chief engineer for the Federal Power Commission, the party made an extensive 19-day survey of development possibilities of the river and its tributaries. They started at the river source at Columbia Lake, British Columbia, then traced its route through Canada, Idaho, Washington and Oregon.

According to C. E. Webb, chief engineer of the Dominion Water & Power Bureau in British Columbia and a member of the tour, the bureau plans to launch a survey this year to determine potential water power and other natural resources of the Columbia River basin in Canada.

"Continuation of the studies of the joint commission will not hold up new developments in the meantime," Webb pointed out. "These will be dictated by immediate and sectional needs but their authorization will be based on the studies of the commission looking to a complete scheme for the future." he declared.

● SALE OF Oregon Gas and Electric Co. properties in Clatsop, Columbia and Washington counties to the West Oregon Cooperative, Inc., of Vernonia for about $130,000 was approved recently by George H. Flagg, public utilities commissioner. Funds were supplied by the Rural Electrification Administration. Contained in the order was a stipulation that future rates and minimums for service shall not be higher than those charged by the private utility.

HETCH HETCHY POWER DISPOSAL UNSOLVED

San Francisco's Hetch Hetchy power dilemma, alternately solved and unsolved during the past month, is back where it was originally when the federal courts ruled that any agency agreement for disposal which involved the Pacific Gas and Electric Co. was illegal. However, another respite has been granted by Federal Judge Roche, this time until March 1, 1945, to permit working out a new disposal arrangement which will be satisfactory to Secretary Ickes.

Working on verbal assurances from Abe Fortas, Undersecretary of the Interior, city officials perfected an arrangement whereby PG and E would deliver Hetch Hetchy power for all municipal requirements, including buildings, street railway and street lights without cost to the city. In return for this service PG and E was to receive 2½ kwh. of power at its Newark substation for every kilowatt-hour it delivered inside the city. PG and E was to perform all services and to maintain all equipment including street lights. The saving to the city in power costs would approximate $2,350,000 annually as contrasted with present Hetch Hetchy income of $2,400,000.

This proposal was ruled illegal under the terms of the city's grant of water rights. The Interior Department suggested instead that the city negotiate for or condemn a portion of the PG and E system sufficient to deliver power for its own municipal uses and that it arrange to sell the balance to Navy yards and other federal installations on San Francisco Bay. Another alternative is to secure Congressional amendment of the Raker Act so as to permit sale of power to privately owned utilities.

● THE SEATTLE CITY COUNCIL utilities committee has approved an appropriation of $91,000 from City Light Department funds to improve the city's railway in the Skagit River power development, and to purchase new equipment for the Gorge Dam power house. Light Superintendent E. R. Hoffman asked $70,000 to repair the roadbed and bridges of the railway, and $9,500 to install additional overhead electrical facilities. Purchase of a new 15,000-volt switch and other equipment for the power house will cost $11,500, it was estimated.

Electrical Wiring is Basic!

That's why Anaconda's national advertising drive is important to every electrical utility

ANACONDA's advertising campaign is aimed at creating a sounder basis for your postwar business. It urges postwar planners to allow extra capacity in wiring plans. It puts the spotlight on the big increase in the demand for power and equipment sure to come.

Don't overlook the opportunity to tie in with this special campaign. Plan now to get a maximum share of its benefits. Link your own promotion to your local adequate wiring bureau activities and Anaconda's basic advertising theme: It's always wiser to Wire Ahead! 44262

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THINK AHEAD Electrically
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ANACONDA WIRE & CABLE COMPANY
Electrical Wires and Cables of Copper are the Life Lines of our Nation

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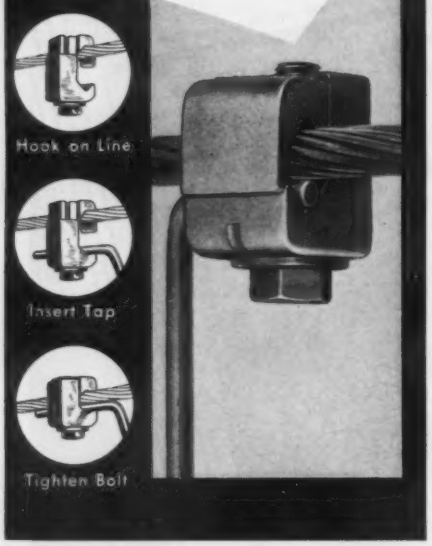

You cut out waste motion when you use the Fargo Connector. It's built as one unit, free from loose parts, and *always threaded.* No time lost starting a nut, no chance of cross threading.

Re-use the Fargo Connector, again and again. With its rugged Everdur body and Duronze bolt, the Fargo Connector "grips like a vise" every time.

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UTILITY RATE HEARINGS BEGIN IN CALIFORNIA

Contending that the proposal would in part circumvent the government's war finance program and that no real saving would be realized by customers, California utilities opposed at last month's hearings in San Francisco and Los Angeles the State Railroad Commission plan to eliminate from base rates amounts paid as excess profits taxes. (EWEST July.)

In calling the hearing, the commission charged that the state's 130 utilities were meeting excess profit taxes, not out of profits, but by charges collected from customers amounting to approximately $100,000,000 a year, argued that rate reductions wiping out such profits would not affect earnings or dividends. It was stated at the outset that no rate reductions were contemplated in the hearings and that such reductions must necessarily come as a result of separate proceedings against individual utilities.

Utility spokesmen declared that virtually all of the increased revenue has come from government business and has been returned in the form of taxes and that, should the commission deprive the government of this revenue, the ultimate consumer would be called upon to make up the deficit.

Officials of Pacific Gas and Electric Co. pointed out that since 1939 electric rates have been reduced $4,225,000 annually and gas rates $5,450,000 annually. This was contrasted with rise in the cost of living in the Bay area for the same period.

Underlying the argument is the question of jurisdiction and whether or not the state commission has the right to invade a field of regulation which is delegated under the constitution to Congress. Thomas Tarleau of New York, who helped draw up the Excess Profits Tax Act, and who appeared as a witness for the utilities, contended that the excess profits tax should be considered in the same light as any other income tax. He stated that there had been no congressional discussion on the subject of whether such taxes could be passed on to the customers or should be considered in connection with the establishment of rates for utility services.

● Pacific Power & Light Co. will return another $300,000 to its customers in a second wartime rate "dividend," it was announced recently. The dividend plan has been adopted by Pacific and several other utilities as a means of adjusting rates to present conditions.

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

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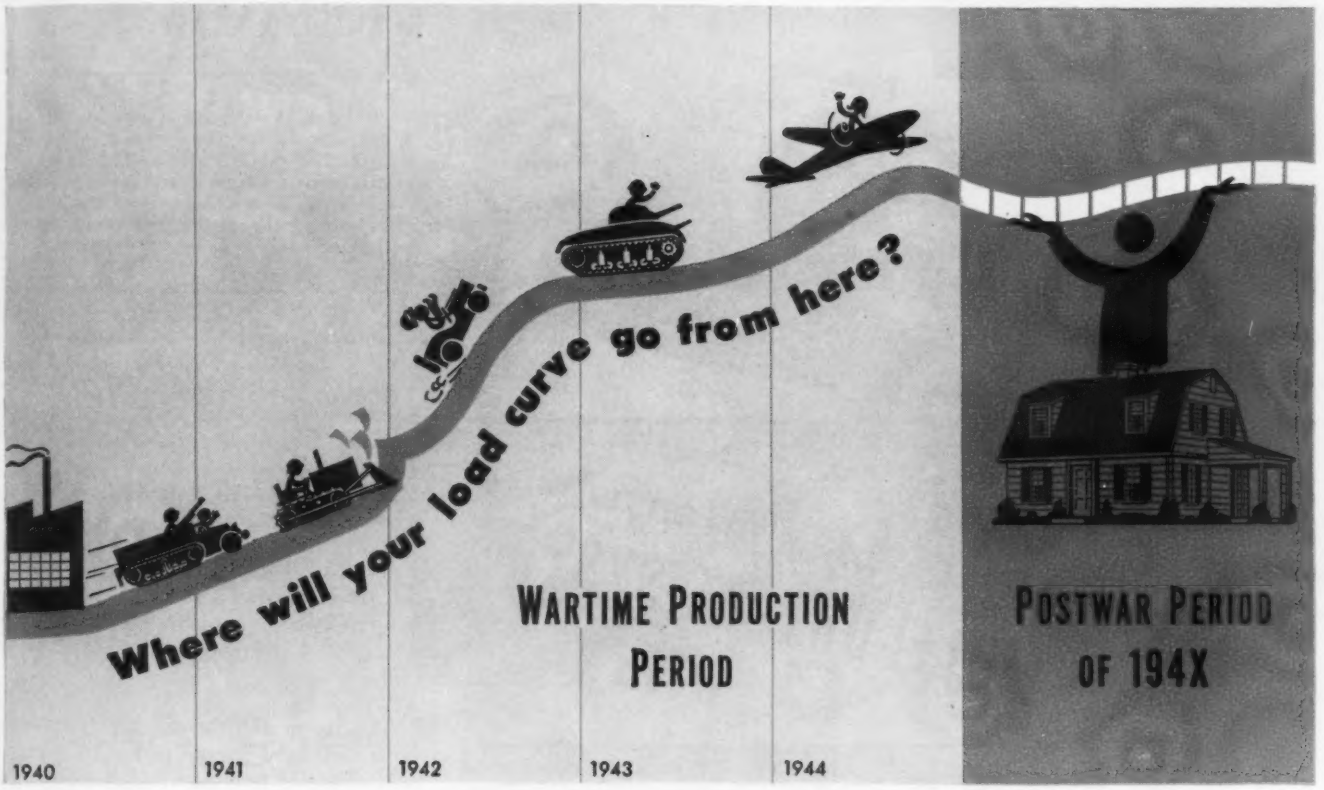


HOW rapidly utility loads return to present high levels, when the war is over, will depend to a large measure on how successfully utilities increase *peace-time residential loads.*

All signs point to a tremendous expansion in the use of electricity in the homes of 194X. These highly desirable and profitable domestic loads cannot be achieved to the maximum until the public is educated to demand "*better wiring for better living.*"

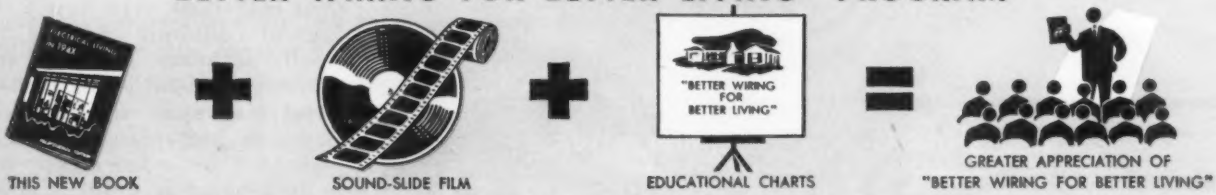
The Westinghouse Better Homes Department has embarked on a new program to help you break your bottle-neck in domestic loads—caused by *inadequate* home wiring.

This load building program is built around the new book..."Electrical Living in 194X"... designed for the building profession and allied interests, *including utilities.* It will help you explain to home owners the urgent need for proper wiring—correct lighting and lighting controls—modern circuit protection, etc.

Further—to promote this program, we have prepared a *sound-slide film* and *chart* especially for utilities. Your representatives can use this material in selling the need of "wiring ahead" . . . to local architects, engineers, builders, contractors, wiremen and other factors in the building industry.

For complete information regarding the "Better Wiring for Better Living" Program, communicate with your Westinghouse District Office or write: Better Homes Department (EP-94), Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pennsylvania.

"BETTER WIRING FOR BETTER LIVING" PROGRAM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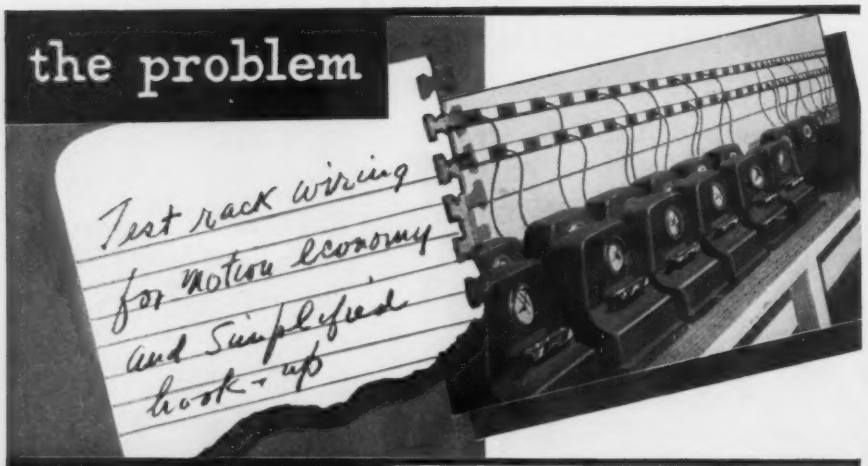

the answer

PLUGMOLD "plug-in-anywhere"
MULTI-OUTLET SYSTEM WIRING

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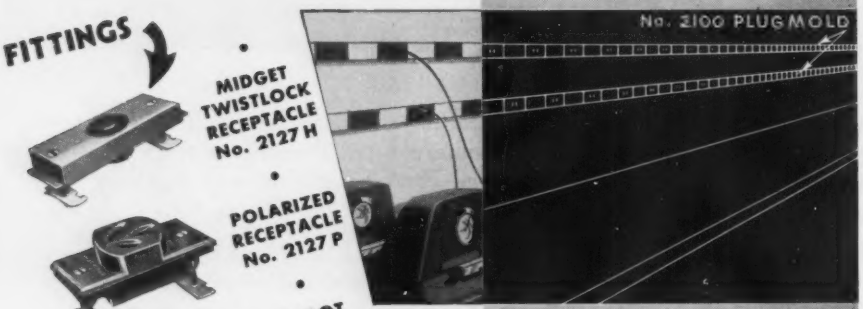

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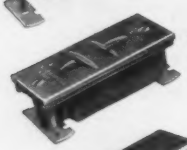
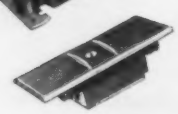
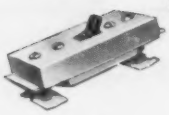

T-SLOT RECEPTACLE No. 2127 S


PLUG RECEPTACLE No. 2127


SINGLE POLE SWITCH No. 2140

● With Plugmold, it is a simple matter to plan work-speeding wiring conveniences such as this test rack installation . . . with any desired number of outlets in any required combination . . . EXACTLY where they are needed.

Plugmold finds application wherever power must be brought to the workers' fingertips in industry. Future planning for hospitals, schools, stores, public buildings and homes will also stress this most modern approach to wiring for functional utility. Write for Plugmold data sheets and new Wiremold bulletins detailing installation.

WIREMOLD CAN HELP YOU PRODUCE FOR WAR . . . WHILE YOU PLAN FOR PEACE!

KNOW YOUR
WIREMOLD
AND YOU KNOW THE ANSWERS

THE WIREMOLD COMPANY HARTFORD 10, CONN.

CONTRACTORS CLEARED IN ANTI-TRUST CASE

Judge Yankwich granted the defense motion for dismissal on Aug. 30 on the grounds of insufficient evidence to prosecute. Thus the defendants were cleared of every charge in the original indictment.

Nothing can be so tedious as minutes of meetings. The morning session had closed with endless reading of minutes introduced by the government attorneys as final submission of evidence against the electrical contractors and unions in the five-year delayed trial charging anti-trust law violations. The government had rested its case. As accused and accusers filed back into the austere courtroom of U. S. District Court, in San Francisco, they found the room filled with little children—a civics class come to see how justice was meted out.

The irony of it struck attorneys for both sides and the defendants. Smiles replaced the tension of a wearisome end to two weeks of testimony and accusation. Sandy headed, smooth spoken U. S. special attorney Frank Loughran joined one group of children to inquire why they were there. White haired, grandfatherly "Cap" Kenney brought rotund defense attorney Harold Faulkner over to greet another group.

When the jury filed in it seemed as if the strains of Gilbert and Sullivan could be expected any moment to herald the entrance of Judge Leon R. Yankwich, of Los Angeles, called from that district to sit on this case. But it continued to be a dull day, despite the youthful guests, for the defense attorneys petitioned for a dismissal of the case, claiming the evidence submitted by the U. S. attorneys was insufficient to hold.

Original indictment in this case was brought late in 1939. It was the first of the run of anti-trust cases brought by the government. Maintaining that their operations were legal within the laws of California and that theirs is wholly intrastate commerce, and thus not within federal jurisdiction, the accused contractors and unions of the Bay area had refused to plead *nolle contendre*, pay a fine and promise not to do it again as so many others had done. One group in Philadelphia had done so and later was sued for fabulous damages and had to pay because of admission of guilt after such a plea.

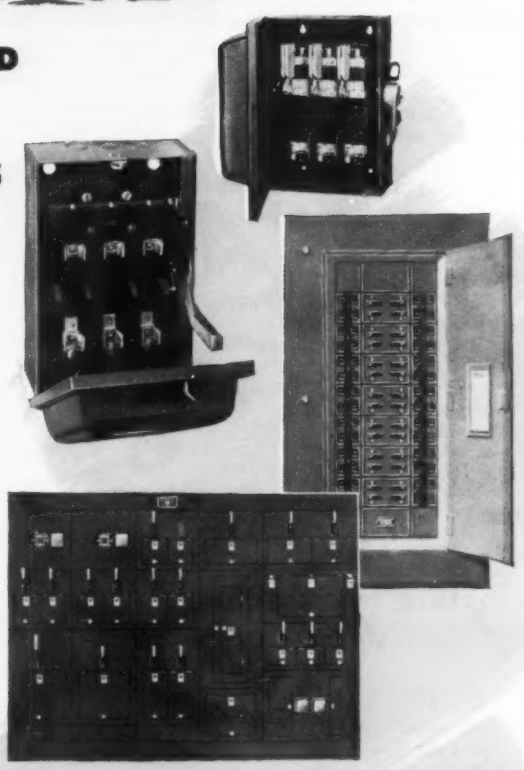
Under the cloud of indictment for five years, much of the time under

(Continued on Page 96)

SQUARE D Positive Pressure FUSE CLIPS

MEET HIGH SHOCK REQUIREMENTS FOR USE WITHOUT AUXILIARY FUSE-RETAINING GADGETS

STANDARD FEATURE IN ALL SQUARE D SWITCHES, PANELBOARDS AND SWITCHBOARDS FOR 30-60 AMPERES



In spite of the tremendous shock of the big guns on fighting ships, the Navy accepts these clips without auxiliary fuse retainers. The powerful gripping force of the built-in steel spring does the job.

This, plus the fact that Square D Positive Pressure Fuse Clips are copper instead of the usual bronze, means (1) higher conductivity and (2) up to 60% heat reduction at the point of contact between clip and fuse ferrule. Yet fuses may be quickly and easily removed and replaced without fuse pullers or other "trick" devices.

The same basic principle is also used in all Square D fuse clips from 100 to 600 amperes, providing the same positive contact and reduced heating. The positive pressure feature is entirely automatic, requiring no bolts or clamps which loosen under vibration, shock or the wearing of threads.

Pressure fuse clips are just one of the many reasons Square D is preferred for marine applications.

SQUARE D COMPANY

LOS ANGELES • DETROIT • MILWAUKEE

. . . does 3 JOBS EFFICIENTLY

Advance* is a Driver-Harris alloy made from electrolytic Nickel and Copper, possessing a number of remarkable properties ideally suited for these 3 distinctly different applications.

1. High electrical resistance (294 ohms per Circular Mil-foot), great ductility and non-corroding properties make it particularly good for winding resistors employed in motor starting and controlling equipment. Wire and ribbon are used in this application.

2. In finer sizes *negligible* temperature co-efficient of resistance (±.00002) combined with high resistivity makes it the most desired resistance alloy for precision electric meter resistors.

3. Because Advance develops high and uniform thermal e m f against Platinum, Copper or Iron, it is used extensively by all instrument manufacturers in the well-known Iron-Advance and Copper-Advance (Constantan) Thermocouples.

Write for a free copy of D-H alloys Data Book R-42.

** Trade Mark Reg. U. S. Pat. Off.*

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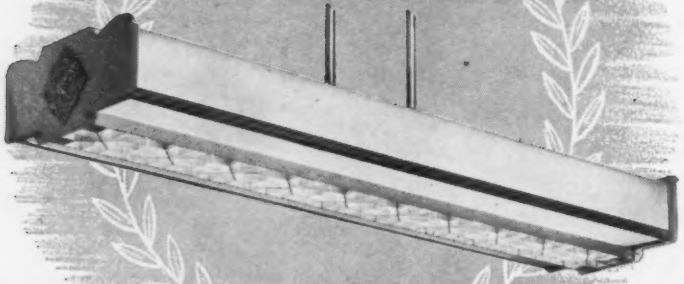
The Curtis
STARLUX



famed for Beauty and Efficiency

Where customers demand quality in a four-lamp pendant fluorescent luminaire, Curtis StarLux is a natural choice.

Substantially constructed of durable materials, this beautiful luminaire is characterized by the careful design and workmanship which has made Curtis equipment a leader in the quality lighting field for over half a century.

On the next job that requires beauty, efficiency and lasting quality, specify Curtis StarLux.

Write for our illustrated folder, Serial 2039, giving full information.

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CURTIS *Lighting*, INC.

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bond, the three electrical contractors associations, two unions, seven companies, 20 individual contractors, officials of the two local unions and even former president Dan Tracy of the International Brotherhood of Electrical Workers, had been eager to go to trial and get it settled.

But delays came, chiefly from the government. It had a "hot wire" in its net, due to some naive oversight. Dan Tracy, meanwhile, had become Assistant Secretary of Labor, appointed by President Roosevelt. Judge Roche of San Francisco district had taken the case off the calendar in disgust and when it was reopened asked that someone else sit on the case. Judge Yankwich, experienced in recent anti-trust cases, was brought from Los Angeles; trial date set for Aug. 15.

In presenting the case before the jury, at its opening, U. S. special attorney Frank Loughran outlined the contention of combination in restraint of trade. The two associations, San Francisco Electrical Contractors Assn. and Electrical Contractors Assn. of Alameda and Contra Costa Counties, were accused of agreeing with each other and the two locals No. 6 and No. 595, IBEW, setting up a bid depository, requiring all bids to be filed, holding meetings to agree on prices and coercing non-members into compliance under threat of denying union labor to work for them. The A. E. Rowe Co. price guide was also brought into the charges. Because of leadership by officers in the associations in the establishment of the bid depository, the inference was drawn that the latter was used as the instrument for coercion.

In the first two weeks of the case, the government attorneys called witnesses from major wholesale houses, many independent contractors, and submitted about 150 exhibits consisting of minutes, letters, by-laws, regulations and records. Wholesalers on the stand testified that a very small percentage of their total business came from contractors and that contractors bought very little material direct from out of the state. The contractors on the stand were adroitly questioned for possible malice in their accusations by Harold Faulkner, of the defense staff. When the government rested its case, Friday, Aug. 25, the evidence presented had not proved damaging if the interpretation of the intent and purpose of the activities was not misread. On this basis Faulkner moved for dismissal.

Arguments for and against dismissal were to be heard by the judge Aug. 28 and 29. If denied, the defense will then present its case.

(Continued on Page 98)

Here's a Fuse Cutout That WILL SAVE YOU MONEY

wherever transformer secondaries are not banked

ENCLOSED, NONINDICATING
Over 1,500,000 in Service

1. Wet-process porcelain housing, glazed inside and out, has ample mechanical and insulation strength.
2. Barriers, on both housing and Textolite door, interleave to prevent conducting arc gases from bridging the contacts when high currents are interrupted.
3. Silver-plated, heavy-duty, self-aligning contacts of the high-pressure-blade type assure permanently low contact resistance, low operating temperature, and long life—even under heavy loading or unfavorable atmospheric conditions.
4. When the cutout door is opened, the fuseholder is removed from both contacts, and is safely isolated from the contacts by a generous clearance.
5. The fuseholder, which has silver-plated contact blocks, can be removed or inserted without tools. Even in the dark, it cannot be placed in the cutout door incorrectly. (The same is true of the disconnecting blade, which can be used in place of the fuseholder.)
6. The hanger clamps to the crossarm, and provides choices of vertical or down-tilted, and straight-out or swiveled positions of the cutout.

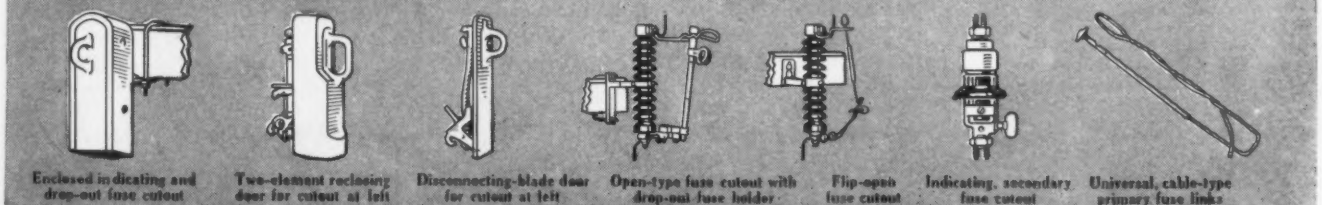
Stocked in 50- and 100-ampere, 5000-volt and 7500/12,500-volt Gr. Y ratings

Reliable in any weather - - works without moving parts

Lowest in price of all wet-process, porcelain-enclosed types, these nonindicating cutouts afford a considerable saving on transformer installations not having banked secondaries, where the location of a blown fuse is indicated by a phone call from the consumer whose service is interrupted.

Since these cutouts were introduced, in 1928, all contacts, fuseholders, and other parts have been interchangeable. Such standardization reduces your stocks and maintenance costs. For complete information, ask our local office for Catalog GEA-2489C. Or write General Electric Company, Schenectady 5, N. Y.

Remember these other G-E devices for complete, economical overcurrent protection



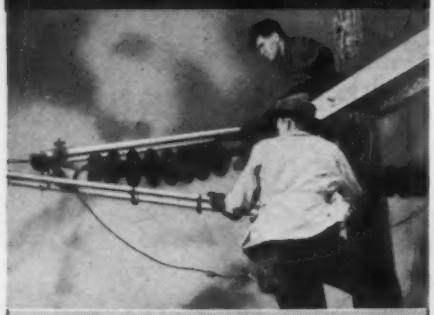
Enclosed indicating and drop-out fuse cutout | Two-element reclosing door for cutout at left | Disconnecting-blade door for cutout at left | Open-type fuse cutout with drop-out fuse holder | Flip-open fuse cutout | Indicating, secondary fuse cutout | Universal, cable-type primary fuse links

GENERAL ELECTRIC

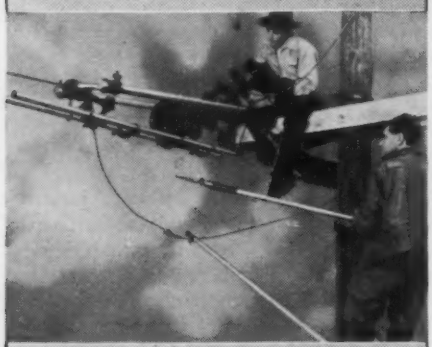
406-17-5264

BUY WAR BONDS

New "cradle" device simplifies dead-end insulator changes



Here the strain carrier has been applied and the lineman on the pole is placing the cradle in position under the insulators. Strain will be released with a ratchet wrench on the strain carrier.



After strain has been released from the insulators, the lineman on the pole releases the cotter key with a key puller and insulators are pulled in on the cradle for making changes.

A safer, easier job with TIPS TOOLS

Changing dead end insulators on high voltage lines without interrupting service is an operation that usually requires less than an hour's time with the use of Tips Tools. Linemen work in complete safety and by using the new Tips suspension cradle for carrying the weight of released insulators, the job is greatly simplified.

The above photos show an insulator change being performed on a 110 KV line. The new cradle is hung under the strain carrier and released insulators may be pulled in over the cradle for changing defective units. Note that the jumper is held at a safe distance by a Wire Tong. By this improved method, dead end insulators on crossarms or corner poles can be changed in the same amount of time that would be required to do the job cold, thus the time required for obtaining clearances, switching, etc., can be saved.

The big factor, of course, is the prevention of outages. Cut the risk of long service interruptions by outfitting Maintenance crews with Tips Tools for quick, safe repairs while the power is on. Get the details from our catalog or write for specific information.

CONSULT YOUR TIPS TOOL CATALOG

ABC INDUSTRIES

A·B·CHANCE CO. CENTRALIA MISSOURI

Attorneys for the defendants are Walter J. Walsh, Harold Faulkner and J. M. O'Conner and Shapiro and McKenzie, representing the union. For the government the case is under James M. Henderson and Frank Loughran and Joseph Alioto. Since the indictments were brought, two of the defendants have died, another retired, officers of the union have been moved. The case is an important test of states rights and of the definition of what constitutes interstate vs. intrastate trade. A California Supreme Court decision had upheld a similar bid depository in a Sacramento case.

Seattle City Light Moves To Acquire Properties

City Light Superintendent Eugene R. Hoffman has asked the city council of Seattle to appropriate $7,500 out of City Light funds to permit employment of engineers and technicians to make a report on possible acquisition by City Light of 5,000 acres of land and timber in Canada, which will be flooded when construction of Ross Dam in the Skagit River power development is completed.

Assistance of experts also will be sought in the plans now being completed for the sale of timber in Ruby Basin, which will be flooded by present and future construction of Ross Dam. Hoffman said there is approximately 100,000,000 ft. of timber in the basin, most of it in Whatcom County. When the second step of the dam is completed, raising its height 475 feet above the present level, it will impound a reservoir 17 miles long. However, the flooding of the Canadian lands at the upper end of the basin is not expected to occur until the third, and last, step is added to the dam in the future.

● BONNEVILLE POWER Administration has received WPB authorization for construction of a 54-mile, 230,000-volt steel tower transmission line from Columbia, Wash., to its Midway substation at Vernita, Wash. A switching station at Columbia, on the east bank of the river about 20 miles southeast of Wenatchee, and additional facilities to handle the line at Midway substation were included in the authorization. Cost of the job is estimated at approximately $2,670,000.

● PG AND E OFFICE WORKERS at Emeryville will be represented for collective bargaining purposes by the CIO, as the result of an election held recently under NLB order. The union was defeated last October, but was awarded another election after membership in the group was boosted.

USE Mailway Banking

FOR SAVINGS AND CHECKING ACCOUNTS

For the convenience of your business or household — a Mailway checking account. For safe and systematic accumulation of a cash reserve—a Mailway savings account. Both are available to you, affording quick reliable service from one of the oldest and strongest banks in the West. Open a Mailway account today.

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NEW "MITCHELITE"

ALL-STEEL INDUSTRIAL FLUORESCENT FIXTURES

Engineered for

Rugged Durability

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Unexcelled Lighting Performance

9 STAND-OUT FEATURES

1. RIGID ALL-STEEL REFLECTORS AND WIRE-WAYS FOR LONG SERVICE
2. OPEN-END AND CLOSED-END TYPES IN 2-40, 3-40 AND 2-100 WATT MODELS
3. CHOICE OF BAKED ENAMEL OR PORCELAIN ENAMEL FINISH
4. AIRCRAFT-TYPE "INSTANT-LATCH" —QUICKLY RELEASES REFLECTOR
5. EASILY JOINED END-TO-END FOR CONTINUOUS ROW LIGHTING
6. ACCESSORIES FOR EASIER, QUICKER MOUNTING OR HANGING
7. NEW, PERFECTED "INSTANT-START" AVAILABLE ON 2-40 WATT MODELS
8. U.L. AND E.T.L. APPROVED THROUGHOUT
9. UNEXCELLED LIGHTING PERFORMANCE —MEETS E.T.L. REQUIREMENTS

PRIORITY: AA-5 for new lighting projects. AA-2 under MRO.

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MITCHELL *Manufacturing Co.*

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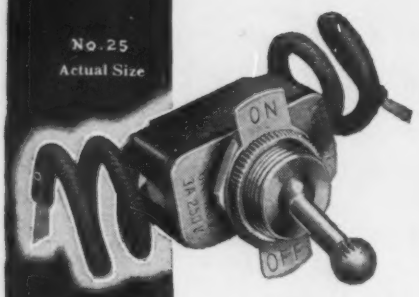
Vibration and Dust PROOF

No. 25 Actual Size



McGILL Toggle Switches

Here is a new addition to the McGILL line of dependable switches . . . the McGILL Toggle Switch, Nos. 25, 27 and 28 Series. This small, practical, thin, multiple switch is both vibration and dust proof. With a body only 1" long, ½" wide and ½" thick, it fits into the shallowest of places. Approved by the Underwriters' Laboratories, it is ideal for the individual control of small tools, fractional horsepower motors, industrial and office machines, appliances, motion picture projectors, floor and table lamps, airplane and trailer lights, lights in Pullman cars, passenger cars and busses.

They are made in three types. No. 25 single pole rated 6 amp. "T" 125 volts, 3 amp. 250 volts. No. 27, three way, rated 6 amp. 125 volts. No. 28 two-circuit, no off position, rated 6 amp. 125 volts. All types furnished with wire leads or solder lugs.

McGILL Toggle Switches are easily installed and built for long life. See your dealer, or write for further information.

McGILL MANUFACTURING COMPANY, INC.
Electrical Division
VALPARAISO, INDIANA

SALT RIVER VALLEY GROUP APPROVES REFUNDING PLAN

A refunding bond issue designed to place bonded debt of the Salt River Valley Water Users Assn. on a long-term, low interest base was approved at a referendum election of shareholders in Phoenix, Arizona. The state supreme court, in a friendly suit, had challenged the legality of the issue and had ruled that it be ratified by a majority of the shareholders.

Under the refinancing plan, the association will convert $7,332,000 of bonds maturing in 1948. The new issue will bear a 3% interest rate as compared with 4¼% for the outstanding bonds.

Since the beginning of the war, the association has been on a pay-as-you-go basis, with receipts from water and power covering bond maturities and federal construction charges. According to Lin B. Orme, association president, government construction charges have been prepaid through 1949 in the amount of $1,307,000.

Court Finds for Utility In Tax Valuation Case

Holding that the Arizona state tax commission had arbitrarily increased the assessed valuations of Arizona Edison Co.'s Yuma properties by $200,000 and had charged an excessive state property tax, the Wuma County superior court recently awarded the utility a $4,626 judgment.

Of the recovery, $2,681 represented taxes paid under protest on the property valuation, allegedly increased without notice or hearing, and the remainder was the amount the company paid on the property tax rate held to be 16% higher than it should have been.

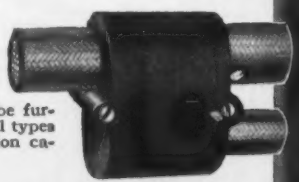
● IMPERIAL Irrigation District recently took formal possession of electrical properties of the Imperial Valley Electric Co., subsidiary of the Arizona Edison Co. Acquisition of the properties for approximately $25,000 makes the district the exclusive agency for distribution of electric power in the county. Since last October, the district had been selling power wholesale to the private company at a rate of approximately $10,000 a year.

● MANPOWER SHORTAGE and unfavorable weather will force a delay of more than eight months in completion of the second step of Seattle's Ross Dam, it was reported recently. The dam, which was to have been finished by Sept. 15, will not be completed before next June, it was stated.

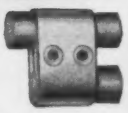
from the MOST COMPLETE line of Cable Taps

Now you can select from a really *complete* line of standard and special taps. Every one carefully designed and manufactured.

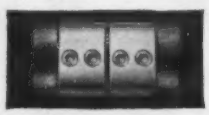
Parallel and 90° taps — and combinations — in the widest variety. For conductor sizes up to 1,000,000 CM.



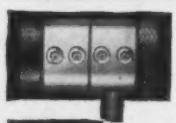
Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union cable taps.



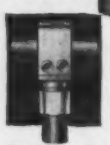
2-way Gutter Tap. Main and branch sizes 8 to 1,000,000.



Two Separate Parallel Taps to a continuous main conductor.



Combination Cable Taps; one branch parallel to main, and one at 90°.



Hinged Clamp of Penn-Union Type HFM makes installation easy. Multi-slit tapered sleeve assures permanent grip on branch.

Positive Equalized Pressure on main and branch, with Penn-Union Type SM. Tightening torque is accurate measure of the clamping force.

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Conductor Fittings

Sketched for Electromaster by George W. Walker, noted industrial designer, this "Electric Range for Tomorrow."

CHOOSING TOMORROW'S ELECTRIC RANGE

ELECTROMASTER
MODEL 15-1

Tomorrow's electric range may follow tradition. It may incorporate radical changes. If it is an Electromaster range first emphasis will be, as always, on efficient, economical, clean *cooking*. Electromaster Model 15-1, shown at right, features 6-quart Vita-Miser cooker, extra heavy spun glass oven insulation, built-in interval timer, and removable, easily cleaned vent grill.

Presently engaged in the manufacture of war materials, Electromaster is also designing improved electric cooking equipment for peacetime output. Greater visibility of cooking operations, accident-proof controls, a more efficient top working surface, and better illumination will be made possible by using new materials and taking advantage of recent engineering developments.

In certain localities sales territories are available to distributors.

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FLAMENOL* BUILDING WIRE (Small Diameter)
MEETS ALL REQUIREMENTS

Type SNW **For Wet Locations**

Type SN **For Dry Locations**

Now you can wire buildings completely with thermo-plastic insulated Flamenol Small Diameter Building Wire. Use Type SN for dry locations and the new Type SNW for wet locations.

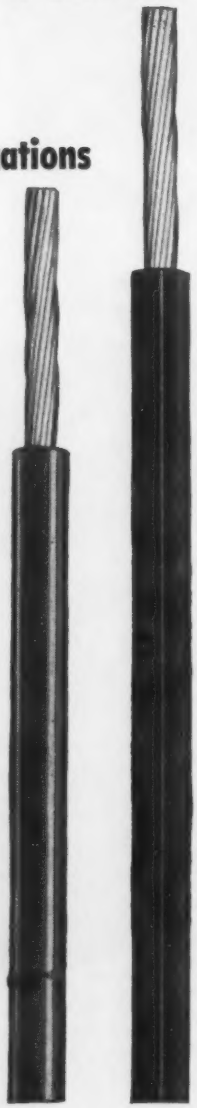
The insulation of both these wires has long life, is high in dielectric and mechanical strength and is resistant to oils, acids and alkalies. In addition, Type SNW Flamenol Wire insulation has low moisture absorption. This wire is approved by the Underwriters' in sizes 14 to 4/0 inclusive for use in raceways in wet locations as follows:

1. *Underground*
2. *In concrete slabs or masonry in direct contact with the earth*
3. *In wet locations*
4. *Where the condensation and accumulation of moisture within the raceway is likely to occur.*

Both Types SNW and SN Flamenol Building Wires are small in diameter and easy to install. For further information see the nearest distributor or mail the coupon for descriptive folders.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news, every weekday 6:45 P.M. EWT, CBS.

*Reg. U.S. Pat. Off.



Both Types SN and SNW Flamenol Building Wire are ideal for maintenance wiring, rewiring and new wiring.

BUY WAR BONDS
AND KEEP THEM

General Electric Company
Section W-941-18
Appliance and Merchandise Dept.
Bridgeport, Connecticut

Sirs: Please send me the folders on Type SNW and Type SN Flamenol Small Diameter Building Wire.

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GENERAL ELECTRIC

GRANGE MASTERS OPPOSE CONGRESSIONAL BILL

Grange masters of five Western states, meeting in Portland last month, went on record as opposed in its present form to the rivers and harbors bill pending before Congress. The group, representing granges in Oregon, Washington, Idaho, Montana and California, contends that the bill would deprive the public of the right to cheap electric power from government reclamation projects by forcing sale to private utilities.

Specifically objected to by the grange masters is the section reading: "The secretary of the interior is not authorized to construct or acquire transmission lines in competition, direct or indirect, with any existing company operating transmission lines for the sale of electric power. Nothing in this paragraph shall be construed as conferring the power of condemnation of transmission lines."

Grange masters of four of the states—Oregon, Washington, Montana and California—also asked the removal from the Army engineers flood control bill of all projects which affect power and irrigation development. In their resolution, they stated their belief that all federal irrigation and power dams should be constructed by the Bureau of Reclamation or by "an appropriate independent regional authority created for that purpose."

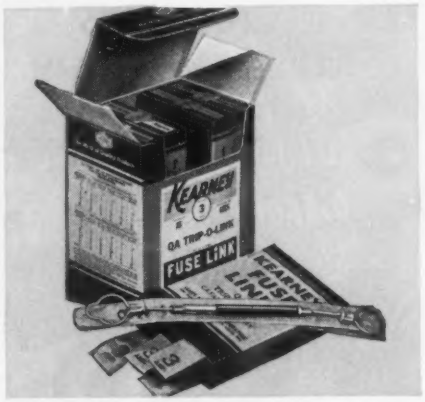
New Mexico Coops Form State-Wide Association

Formation of a state-wide association of New Mexico's rural electrification cooperatives for the purpose of providing a central agency for considering their individual problems and developing a plan for meeting postwar emergencies was completed at Santa Fe in early August.

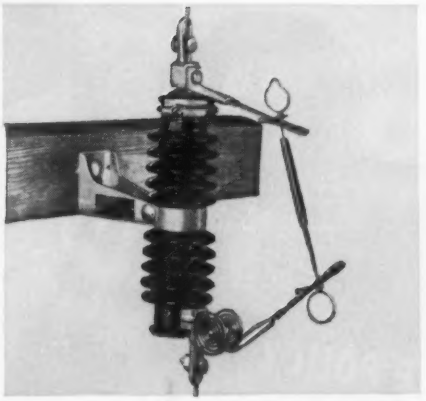
Development of rural electrification and the extension of existing rural electrification lines throughout the state are among the issues scheduled to be laid before the association.

Officers are Oliver Kimbrough of Clovis, president; Gaylord A. Burt of Taos, vice-president, and C. O. Shirey of Portales, secretary-treasurer.

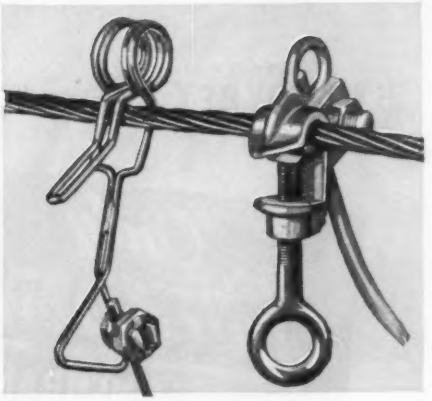
● A TEMPORARY INTERCONNECTION has been made between Bonneville and Northwestern Electric Co. lines near Vancouver, Wash. The connection was made pending completion by Portland General Electric Co. of a tie line between its west Portland substation and Bonneville's St. Johns-Oregon City line and is expected to save oil and hog fuel during the critical dry period.



FUSE LINKS—individually wrapped, then packaged again in packets of five, arrive at the pole just the way they leave the Kearney factory.



LOW MASS, extra-flexible switch parts mean high resistance to mechanical shock and heavy short-circuit rupturing capacity.



CLAMPS. There is a Kearney Con-nec-tap clamp for the most unusual load or construction problem. Made in many types for all wire sizes.

COMBAT LIGHTNING THE EASY WAY

Are you trying to combat lightning discharges the hard way? You are if you're using devices that attempt to choke surges by interposing a high resistance in the path to ground. This method has the effect of keeping a high percentage of the surge on your lines where it may spill over bushings, line insulators or break through transformer windings. In consequence these choked and reflected surges are the direct cause of the many outages from fuse link blowings if not more serious damage, after lightning storms.

The easy way is to direct lightning surges to ground through a low resistance path so that all of the surge, electrical stress and reflected voltage is drained to ground within a fraction of a microsecond. Power follow-ups are snuffed out usually within the first current zero and your lines will operate through many lightning storms without even blowing a fuse link. This is what you may confidently expect when you change to Kearney Lightning Arresters. What's more you start off with the initial advantage of paying much less for the Kearney Arresters—and they will continue to pay dividends by reducing fuse-blowings, trouble-trips and lightning outages to a new low.

Please address your letter to Department "H",

JAMES R. KEARNEY CORPORATION
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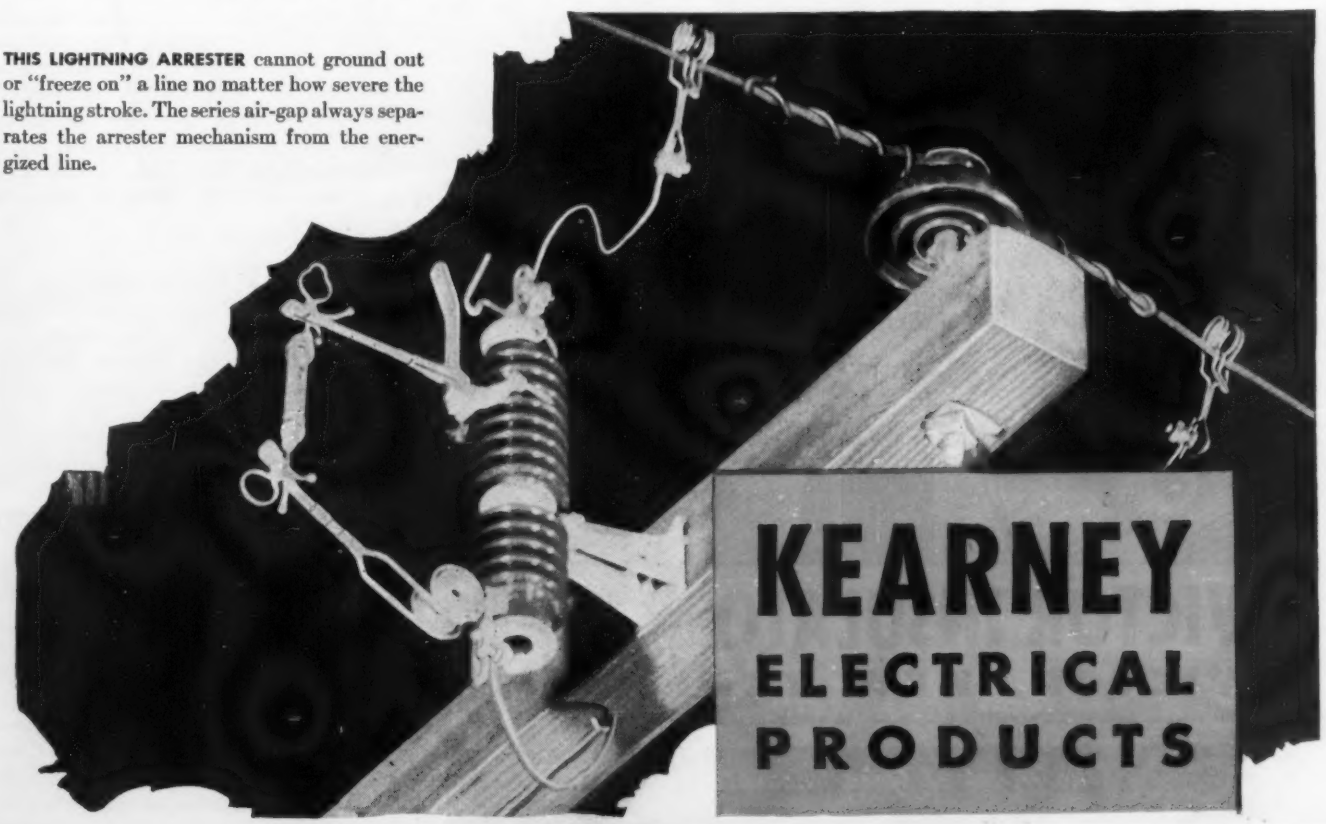
PRACTICAL—SERVICEABLE—DEPENDABLE

THIS LIGHTNING ARRESTER cannot ground out or "freeze on" a line no matter how severe the lightning stroke. The series air-gap always separates the arrester mechanism from the energized line.



KEARNEY
ELECTRICAL
PRODUCTS

B. C. PREMIER CLARIFIES GOVERNMENT POWER PLAN

Declaring that plans for the purchase of B. C. Electric Railway Co. properties by the provincial government had not advanced nearly so far as some reports would indicate, Premier John Hart recently issued a statement clarifying the situation. Eventual control of all electric systems in the province is contemplated in the government plan.

Much study will be necessary before taking any action, Hart stated, and cited as probable moves:

1. Preparation of legislation to be presented for approval at the next session of the legislature.
2. Appointment of a commission, following legislative approval, to be responsible for the purchase.
3. Gradual taking over of other power companies, including municipally operated plants.
4. General overhaul of B. C. Electric equipment and completion of the Bridge River hydro project.
5. Establishment of low power rates that would prove attractive to new industries, and extension of electric services in rural districts not now enjoying them.
6. A refinancing plan, in which B. C. Electric shareholders will be offered long-term, low-interest bonds in lieu of stock.

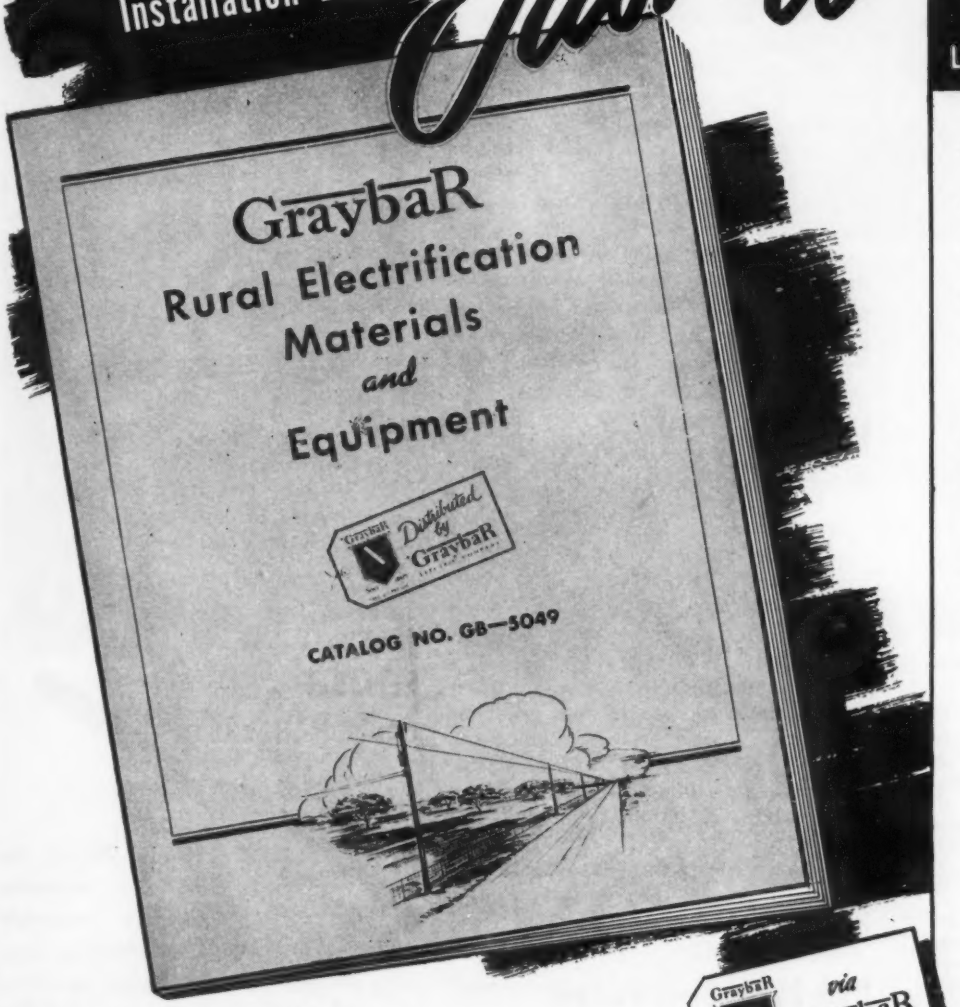
Regarding the $78,951,523 valuation placed on the B. C. Electric properties by the Public Utilities Commission, Hart said that this was estimated solely for rate making purposes and actually represents the company's investment on which it is allowed an income of 5.8%. Possible bad investments and present condition of equipment must be taken into consideration in determining a purchase price, he stated.

● A 55-Mile Transmission line will be constructed by the Surprise Valley Electrification Corp., Lakeview, Ore., to serve 27 ranches between Lakeview and Paisley, it was announced recently, following War Production Board approval. The REA system owns a Diesel plant at Alturas and a hydroelectric plant in Paisley. It has been operating about six years, serves approximately 1,000 customers.

● B. C. Electric Railway Co. has doubled the capacity of its steam plant at Kamloops by installation of a new boiler and turbine-driven generator. Considerable delay has been experienced in building this plant, due to war conditions. The equipment was ordered more than three years ago, but the last of it was received only recently.

TIME-SAVING BUYING GUIDE With Valuable Installation Data

Just off the Press



Up-to-the-minute LISTINGS ON THESE ITEMS

Anchors . . . . Conductors . . . . Connectors . . . . Crossarms . . . . Hardware . . . . Hot Line Safety Equipment and Tools . . . . Insulators . . . . Line Construction Tools and Equipment . . . . List of Materials and Symbol Index . . . . Material Schedule Charts . . . . Meters . . . . Nicopress . . . . Pole Markers . . . . Poles . . . . Reclosures . . . . Rural Line Schedule Drawings . . . . Staples . . . . Strand . . . . Sub-station Equipment . . . . Tap Clamps . . . . Transformers, Cutouts, Arresters . . . . Twist Sleeves . . . . Voltage Regulators . . . . Wiring Supplies.

GraybaR via GraybaR

Here is a brand-new 88 page catalog of the latest and best in available supplies for rural-line electrification. Products of 40 manufacturers specializing in this field are illustrated and described.

In addition, this catalog contains time-saving information on rural installation practices . . . . Nearly 40 drawings of typical rural-line structures . . . . A material schedule to facilitate ordering . . . . Data and materials for farm and rural wiring . . . . An alphabetical index . . . . A Graybar office index, with telephone numbers.

Your copy is ready. Just call your local Graybar Representative, or mail the coupon.

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Sta-Kons are the small wire terminals that eliminate the fuss and hazards of soldering. Quick and easy to install with T&B Pressure Tools—manual or power. Insure a positive electrical and mechanical connection. Resistant to corrosion and vibration. Approved.

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COLUMBIA STREAM FLOW NEAR RECORD LOW

Continued subnormal rainfall in the Columbia River Basin last month threatened the area with one of the poorest water years on record. According to the USGS Water Resources Review compiled early in the month, annual runoff of the river may fall as low as in 1926, lowest runoff in a 66-year period.

While less critical, decreased stream flow was recorded also in Arizona, where flow has been below normal for more than a year. Moderate increases were experienced in Montana, Idaho, eastern Oregon, Nevada and California.

For the West as a whole, natural stream flow was normal or above in about 60% of the area. Except in parts of southern California, there were no areas of excessive flow.

Idaho Power Acquires West Coast Properties

Acquisition by Idaho Power Co. of Idaho electric properties of West Coast Power Co. was approved early last month by the Federal Power Commission. Purchase price was approximately $685,000.

The properties, all in the southern part of the state, are located adjacent to Idaho Power's system. Under the transfer, Idaho Power will gain approximately 3,200 customers and approximately $210,000 of annual operating revenue.

Rate reductions are expected to result in most of the territory under Idaho Power Co. schedules.

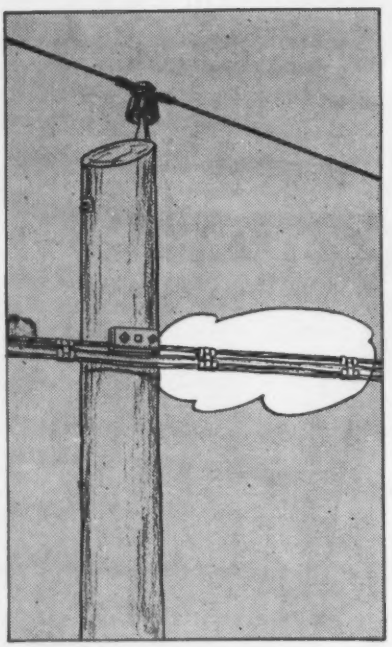
Utah Power Plans Postwar Construction in Ogden

As soon after the war as materials become available, Utah Power & Light Co. will construct a $100,000 building in Ogden to consolidate all service facilities under one roof, it was announced recently by George L. Ellerbeck, division manager. Property has been purchased at Wall and 28th St. and an architect retained, he stated.

Expanded activities in the Ogden area in the past three years, due to increased population and industrial and military operation, make the new building necessary, according to Ellerbeck.

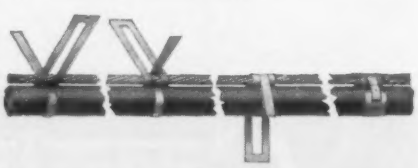
● PUBLIC SERVICE Co. of Colorado won Denver's "Ad of the Year" award for a program in its *High Lights of the Rockies* series, stories in the history of the state and about its people.

Reduce Outages
Avoid Cable Wear
Reduce Maintenance



RELIABLE
CABLE HANGERS

Prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat



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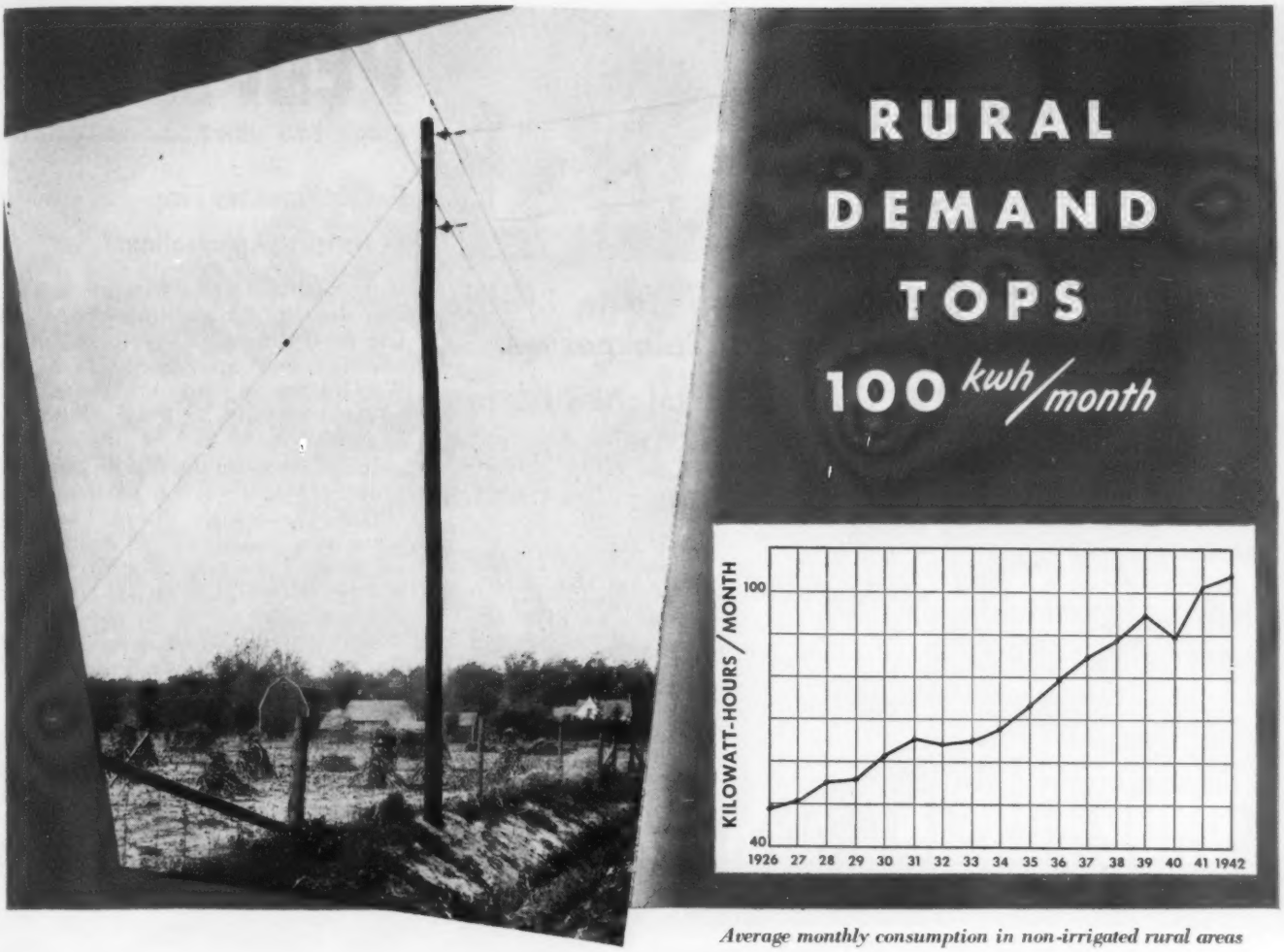
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS



Average monthly consumption in non-irrigated rural areas

Climbing from less than fifty kilowatt-hours per month in 1926 to well over a hundred today, rural power consumption promises to hasten obsolescence of even the latter figure. For, included in that average are many young rural lines, whose customers have not been able to equip themselves with electrical appliances since the war began. Others are just becoming accustomed to having electrical help at hand.

Purchasers of Aluminum Cable Steel Reinforced will recall that Alcoa engineers have always preferred not to recommend conductors smaller than Number 4 A.C.S.R. Alcoa's supervisors, close to the feel of things in the field, prophesied that farm operators would adopt electrical help eagerly. Low conductivity wires would limit the power they could take from their lines.

Consult with Alcoa engineers on the sizes of A.C.S.R which will provide current-carrying capacities permitting future load expansion. A.C.S.R. has the high strength and durability required in modern line construction. ALUMINUM COMPANY OF AMERICA, 2132 Gulf Building, Pittsburgh 19, Pennsylvania.

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TO GREATER RELIABILITY
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Pole Line Hardware And Obtain
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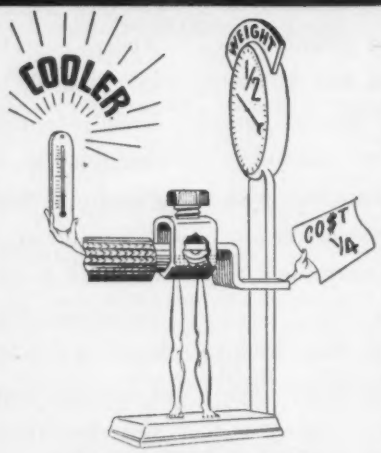

PROVED BY TESTS
Recent tests made by a leading switch manufacturer proved that ILSCO 225 amp. SOLDERLESS CONNECTORS ran 12% cooler than a cast connector of another manufacturer whose connectors are **twice** as **heavy** and cost **four times as much.**
ILSCO CONNECTORS are cooler, lighter, and cheaper because they're built from 100% electrolytic pure copper drawn right in our own plant. Cast connectors, of course, are made of alloy copper with poor conductivity. Make the tests yourself . . . you'll appreciate ILSCO superiority.
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PEOPLE
made this news

Pacific Promotes Five In District Organization

Appointment of L. W. Dick as Yakima district manager to succeed the late R. B. Bragg and personnel shifts affecting four other members of its Washington organization were announced recently by Pacific Power & Light Co.

In the new set-up, R. E. Sinclair, acting manager of the Yakima office during Mr. Bragg's illness, has been transferred to Portland as assistant to the general manager. T. M. Keenan has been appointed to succeed Dick as manager of the company's Dayton-Waitsburg-Pomeroy district, and Karl Koboski has taken over management of the Toppenish district. Phil Clark has been named manager at Wapato.

Dick has been manager at Dayton since 1929. He has been with the company and its predecessors for 31 years and was on the staff of the Washington-Idaho Light & Power Co. when it was taken over by Pacific in 1927.

Utility Employees Win Honors in Bond Drive

A flying fortress in service in the South Pacific area bears the name of a Colorado Central Power Co. employee, L. L. Gann, as a result of participation of the utility, with affiliate companies in the F. W. Woodcock group, in the Fourth War Bond drive. The bomber was one of eight named for employees of the affiliated companies and christened by Col. Frank F. Hennaman, inspector attached to General McArthur's staff in the Far Eastern theater.

Colorado Central Power's participation in the drive was under direction of Francis H. Godwin. Gann, who handles service investigations and complaints, sold $145,163 in bonds during the Fourth Loan drive; combined total for the group was $2,569,669.

Currently the companies are conducting a 1944 War Bond campaign, in which cash prizes are offered to members of the organization on each property selling and buying the largest amounts in bonds and stamps.

● C. H. RATTRAY retired after 38 years with General Electric Co. in Seattle. He was an expert in steam turbines. He joined G-E in 1906 and was transferred to Seattle in 1916.

FWD "TRUCK-POWER"

Overcomes Handicaps of Manpower Shortage

This FWD established an enviable record for Los Angeles' Bureau of Power & Light, by restoring power after floods tore down transmission line towers.

MORE customers to serve . . . and more service per customer . . . with less man-power, restricted materials and limited equipment! . . . and still America's public utilities are coping successfully with these unprecedented service loads.

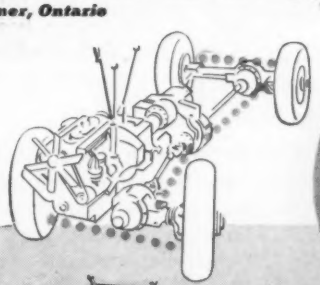
FWD truck-power is being employed by more than 150 utilities to help overcome handicaps of man-power shortage. Fleets of FWDs are proving that they have the ruggedness, four-wheel-power and traction to go "beyond the limit" of average contemplated service. Thousands of FWDs in utility duty are putting their "extra bit" into every emergency or routine duty to keep the pledge of public utilities in rendering service "as circumstances demand". In any weather, over any road, "more power" to the utilities that have built their service soundly around FWDs!

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin

Canadian Factory: Kitchener, Ontario

Four-Wheel-Drive ... THE BACKBONE OF RUGGED, DEPENDABLE TRUCK HAULING POWER

The true application of four-wheel-drive with center differential provides ability to get through under difficult conditions — increased surety and safety on the road — lower operating cost per ton-mile — long service life.



FWD TRUCKS

COMMERCIAL

CONSTRUCTION

UTILITIES

OIL FIELDS

MILITARY

Trade-Mark of the Original and Exclusive Builders of Four-Wheel-Drive Trucks.

Nicopress

REINFORCING SLEEVES

for strengthening damaged Copperweld-copper conductors

Nicopress Reinforcing Sleeves offer an ideal means of strengthening Copperweld-copper conductors at points where one or two of the copper wires have been damaged. These sleeves are split the full length and may be slipped over the damaged section and compressed with the same Nicopress Tool used in making the regular line splice.

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The National Telephone Supply Company

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INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

Allis-Chalmers Announces Personnel Changes in West

Allis-Chalmers Mfg. Co. last month announced two appointments affecting its organization in the Far West. F. Harvey Searight was advanced to San Francisco district manager and James L. McClure was named Pacific regional public relations representative.

Searight has been with Allis-Chalmers for 33 years and had been acting district manager for the past year. Before joining the company in the San Francisco sales and engineering office, he had been with the Charles C. Moore & Co., engineers, American Smelting and Refining Co. and Southern Pacific. Recently he has worked as consultant between the company and PG and E.

McClure, who will have headquarters in San Francisco, has been associated with the electric industry for 25 years. He formerly was commercial and industrial sales engineer for the Sacramento division of Pacific Gas and Electric Co. and more recently had been serving the Sacramento Air Service Command as training coordinator and director of employee welfare.

Edison Co. Reorganizes Comptroller's Department

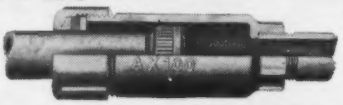
Reorganization of the Southern California Edison Co. comptroller's department was announced recently by C. P. Staal, comptroller. The department was divided into two main groups, accounting and auditing. D. C. Griffin is chief accountant in charge of the accounting group, with C. N. Rudkin as assistant. F. C. McLaughlin is general auditor in charge of the auditing group, with A. L. Chavannes as assistant.

C. R. Duncan is research accountant. R. O. Cross is chief operating and construction accountant, and M. L. Rugless is chief financial accountant.

Thomas Watson is head of the plant and work order division. R. G. Hunt is head of the pay roll division. William C. Stroschein heads the division of stores and field office audits. C. E. Hammer heads a new miscellaneous audits division.

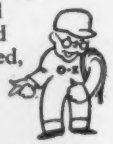
● RUSSELL STARK of Victoria has been appointed manager of the Victoria, B. C., branch of the Art Electrical Engineers, Ltd., of Vancouver, which has opened a new division in that city. Stark for the past 18 months has been at the Vancouver office of Art Electrical. He was previously on the staff of the Hudson's Bay Co. at Victoria.

O.Z. EXPANSION FITTINGS



. . . FEWER PARTS— QUICKER INSTALLATIONS

This unit was designed to compensate for expansion or contraction in a line of conduit. The expansion head is sealed by a high-grade packing, making it moisture proof. Bakelite bushings prevent abrasion of the cables inside the casing. This type, designated as "AX", is shorter and more compact than regular units, is made up of fewer parts, takes up less room and can be installed quickly. Furnished in standard malleable iron, cadmium plated, or in bronze. Also supplied for thin wall (EMT). Ask for type TX.



No Shopping Necessary

Send for the new O. Z. Catalog No. 125. Here you will find, illustrated and described with detailed specifications and price lists, the more than 160 O. Z. electrical fittings including Conduit Fittings . . . Cable Terminators . . . Junction Boxes . . . Solderless Connectors . . . Power Connectors . . . Grounding Devices.

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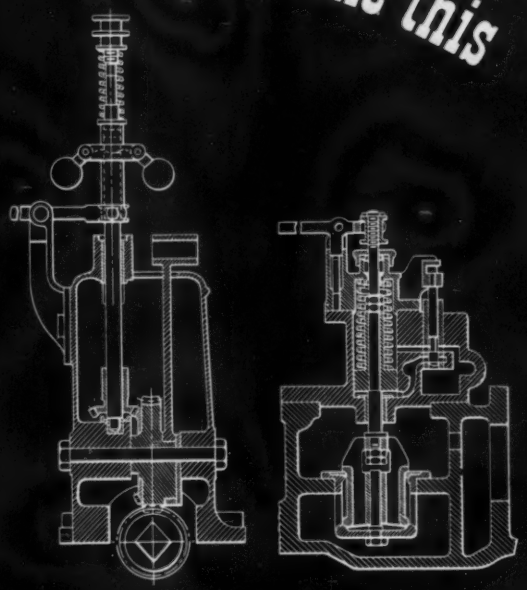
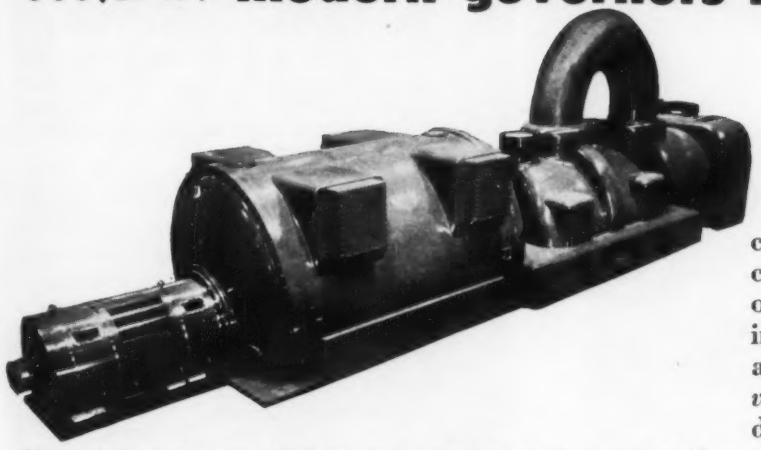
When GOVERNORS were made like this

Lubricating this "Gust Governor" of 1894 was no particular problem. Clearances were ample, mechanism simple. Steam was admitted in blasts, longer or shorter, according to the load on the machine. Attached to the spindle of the double-beat throttle valve was a piston which was normally pressed downwards by a spring above it. Steam leaking at a slow, but determined rate through the bushing of the spindle raised the pressure below the piston and so tended to keep the valve open in opposition to the action of the spring. The emergency shut-down device operated by releasing the steam under the piston of the double-beat valve, allowing the spring to hold the valve permanently shut. In modern types, oil pressure, instead of steam, is used to control the governor mechanisms.



a 1-Job turbine oil would do

...But modern governors need this 2-JOB oil!



The precision mechanism of the governors on today's turbines need an oil that will do more than just lubricate. They need an oil that prevents rust *as well as one that* resists oxidation *to an unusual degree. Shell Turbo Oil does both.*

1. That prevents rust

2. That has superior oxidation stability

The governor on a modern turbine is, of necessity, built to such close tolerances that rust can stop it cold. That's why "that old reliable oil you've been using for years" is out of place in a modern, high-speed job. Today you need a turbine oil that does 2 jobs at once: (1) *prevents rust*, (2) *resists oxidation* to an unusual degree. Shell Turbo Oil does both. Why? Because it's designed for modern turbine use.

A smooth-running turbine today is no measure of tomorrow's performance. Don't wait for rust to strike. Change to Shell Turbo Oil. First of its type to be approved as meeting rigid U. S. Navy specifications, Shell Turbo Oil has built a reputation no turbine operator can ignore. Boasting? No! Facts prove it's so. Why not have a Shell man call and show you the record? Write: Shell Oil Company, Inc., 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

SHELL

TURBO OIL

It's easy to install a
CHROMALOX HEATFLO UNIT
THE REPLACEMENT UNIT FOR ALL ELECTRIC RANGES

Fits all ranges with clip-on adaptor rings —
Cuts inventories —
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Makes happy customers.

Chromalox Super-Speed range units and parts available without priority—under WPB Order L-65.

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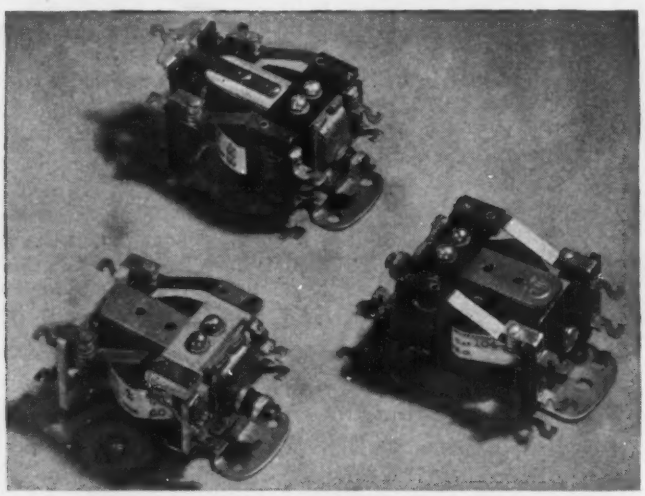
THE PETERSON CO.: 1925 Blake St., Denver 2, Colo.



ADAPTABLE *FOR MANY PURPOSES*

Only 1¼" high. For continuous operation on AC and DC voltages up to 110-115. Double pole, double throw. Send for Bulletin 104.

The Ward Leonard Midget Metal Base Relay has proven so satisfactory and dependable that several adaptations have been made in it to give it even wider application. These relays may be furnished with studs in place of metal bases.

ARMY E NAVY

WARD LEONARD
RELAYS • RESISTORS • RHEOSTATS
Electric control (WL) *devices since 1892.*

WARD LEONARD ELECTRIC CO., 68 South St., Mt. Vernon, New York

Long to Head PG and E Public Relations Bureau

Appointment of E. A. Long as manager of the Pacific Gas and Electric Co. bureau of public relations was announced last month by R. E. Fisher, vice-president in charge of sales and public relations. He succeeds Don C. Ray, who retired after 43 years service with the company and its predecessors; 17 years in the position.

Long joined the staff of PG and E as assistant engineer in 1924, soon after his graduation from Stanford University. He was transferred to the public relations bureau in 1933 and became assistant manager of that department in 1943.

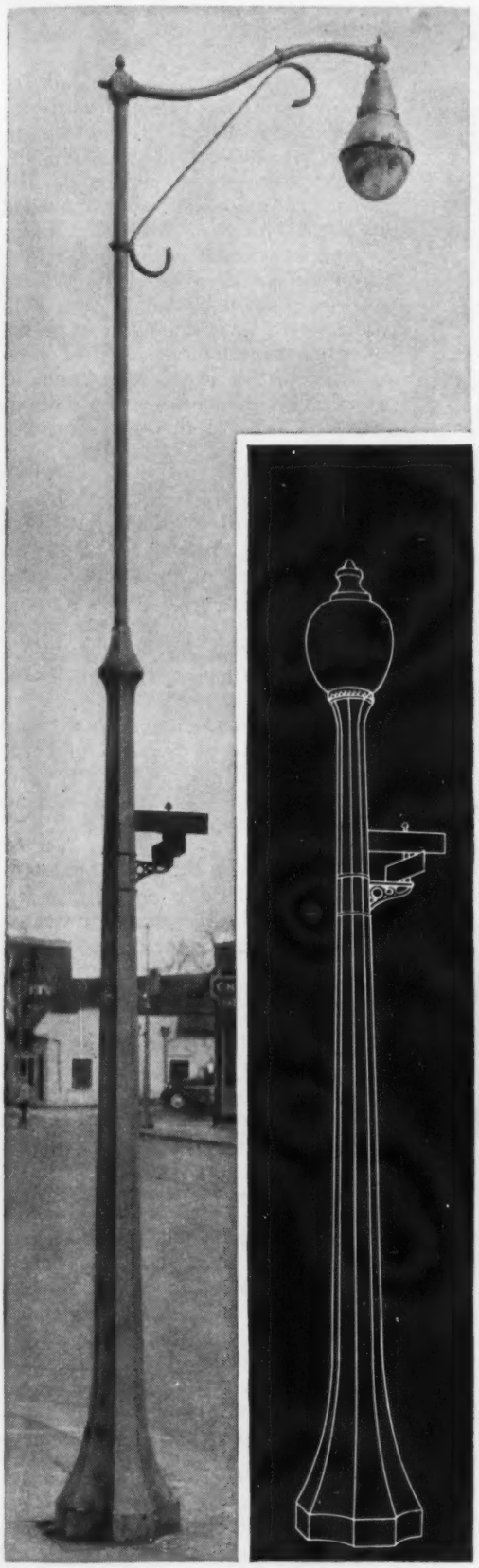
● THREE SOUTHERN CALIFORNIA EDISON CO. engineers are on leave from their Edison jobs for other highly technical and responsible war work. Fred T. Schell, Louis Ludekins and Paul Ilganfritz are in New London, Conn., taking a three-month training course preparing them to be civilian liaisons between the Office of Scientific Research and Development Laboratory at Columbia University and the Navy. This work will take them to many parts of this country and abroad, and will be for the duration.

● JED F. WOOLLEY, Jr., for seven years manager of the Utah Light & Traction Co. before its sale to Salt Lake City Lines, has been appointed construction and maintenance superintendent for Utah Power & Light Co. Woolley became associated with the company in 1919, following service as Captain of Engineers in the last war. From 1922 to 1927, he served the Phoenix Construction Co.

● J. F. RICHARDSON has been named assistant to D. L. Marlett, controller for the Bonneville Power Administration. A native of Portland, Richardson for two and a half years had been with the Bureau of the Budget in Washington, D. C., and had been working primarily on war agency organization programs.

● DR. W. BALLENTINE HENLEY, president of the College of Osteopathic Physicians and Surgeons in Los Angeles, was appointed to the Los Angeles Board of Water and Power Commission last month to succeed James B. Agnew. Agnew had served five years and was chairman of commissioners.

● CHARLES MEIER has left Westinghouse Electric & Mfg. Co., Appliance Division, with which he has been associated for some 20 years, and will become a manufacturers' representative for appliances and allied lines.



LIGHT Directed at the Sky is INEFFECTIVE on the Street

MODERNIZE WITH L-M LUMINAIRES . . . YOU CAN DO IT INEXPENSIVELY

If your street lighting system is of the old-fashioned type that directs 50% of your light at the sky instead of on the street, you can modernize now at little cost.

Convert to L-M Luminaires which distribute light over a wide area, produce maximum visibility and minimum glare. The change can be made easily, using your present wiring system, standards, current regulators, and control equipment.

L-M modern Luminaires are scientifically designed to direct light to give greatest illumination on the ground. This is accomplished by use of a reflector and an enclosing refractor element.

L-M Field Engineers will be glad to show you how quickly, conveniently, and economically your lighting system can be made more efficient.

For full information contact your nearest Line Material sales office or write to Line Material Company, Milwaukee, Wisconsin.

Send for this booklet on modernization. It tells you how you can convert your existing street lighting system into a modern system at little cost.

By changing fixtures, as shown at the left, this city acquired MODERN LIGHTING

★

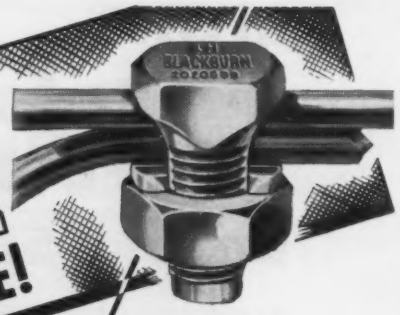
Line Material Company is one of the oldest and largest manufacturers of street lighting equipment. The L-M line of street lighting is complete in every respect—standards, brackets, luminaires, transformers, control and protective equipment.

★

For proper maintenance, L-M offers a complete line of Replacement Parts to fit all standard makes of street and protective lighting equipment—reflectors, sockets, porcelain heads, refractors, and globes. L-M can supply these Replacements on short notice.

LINE MATERIAL
STREET LIGHTING EQUIPMENT

L-M DISTRIBUTION EQUIPMENT INCLUDES: **Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment**



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Yes, BLACKBURN CONNECTORS are the strongest and most durable connectors on the market because they are the only connectors made of Duronze. And Duronze is a high-strength silicon bronze which tests show is up to 35% stronger than ordinary steel, and more non-corrosive than pure copper! Hence, BLACKBURN CONNECTORS will not distort, are trouble-free on the lines, and can be used over and over again. For real economy, it's BLACKBURN!

Millions in use throughout the world

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Over 100 Conveniently-located Jobbers' Stocks

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Builders of Quality Connectors for Over 10 Years

BLACKBURN CONNECTORS

For the Best In **MECHANICAL, THERMAL, CHEMICAL, AND ELECTRICAL PROTECTION**

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Electrical Insulating Varnishes

Get complete information on the complete line of Pedigree Impregnating Varnishes — Finishing Varnishes — Protective Sealers — Sticking Varnishes — Coreplate Varnishes — Insulating Compounds. Write for the free 40-page book.

The PRODUCT with a PEDIGREE

***The* P. D. GEORGE CO.**
5200 North Second Street • St. Louis 7, Mo.

Call in the Pedigree Varnish Man Nearest You

Obituary

● ANNOUNCEMENT of the death of Comdr. Frank L. Eley, formerly of the Southern California Edison Co., in a transport plane crash in the Pacific, was made by the Navy Aug. 2. The officer was one of 18 persons aboard the plane with Rear Admiral Charles P. Cecil, also killed in the accident.

Commander Eley, on military leave from the Edison company since February 1941, was an engineer in the operating department. He had been stationed in San Diego for 14 months prior to his detachment for overseas service in June of this year.

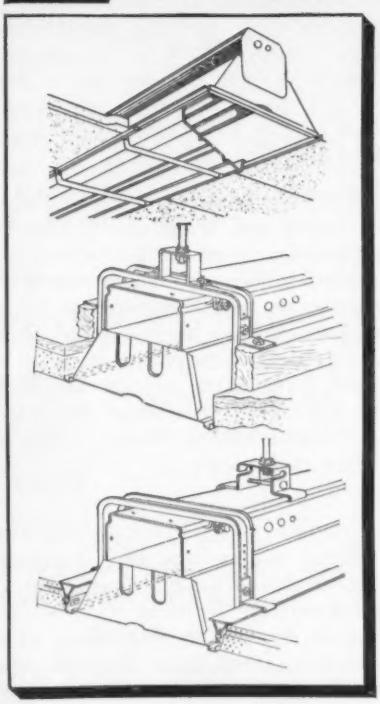
● DANIEL C. GREEN, former utility executive in the West, died in Petoskey, Mich., July 2 of undulant fever, age 59. Mr. Green came to San Diego in 1908 from Purdue University, joined the San Diego Gas & Electric Co. in the new business department. Subsequently he was connected with a utility in Tacoma and later with Utah Power & Light Co., from which he became a vice-president of Electric Bond & Share Co. At the time of his death he was chief executive, by request of the War Production Board, of the Cleveland Pneumatic Tool Co.

● OSCAR WILLIAM BENNETT, 52, assistant treasurer of Puget Sound Power & Light Co., died at his home in Seattle last month. Mr. Bennett was born in Saginaw, Mich., but spent much of his childhood in Tacoma, Wash. In 1908 he joined the Pacific Traction Co. there, leaving in 1917 to enlist in the Army. He was discharged in 1919 as a second lieutenant and returned to the traction company. In 1923 he was transferred to Pawtucket, R.I., returning to the West in 1928 as assistant treasurer of Puget Sound.

● JAMES E. STEWART, president of the Electrical Maintenance Engineers Assn. of Northern California, died in San Francisco, July 30, after an operation for cancer. He had been ill for several months but was considered on the road to recovery. He was chief engineer at the Oakland City Hall and an ardent worker in the affairs of the association.

● HERBERT CHASE MAUGHAN, 74, superintendent of the Logan, Utah, municipal power plant for 40 years, died last month at his home in Logan. A son of Cache Valley pioneers, he became associated with the plant the year after it was established in 1903. He was immediate past president of the Utah war power emergency association. Previous to his association with the Logan plant, he was with the Mountain States Telephone Co.

This ceiling hangs from the lighting fixtures



For simpler, stronger construction in Schools, Offices, Stores & Industry

One hundred years "in lighting" has taught us many things.

Among them the fact that providing better lighting is not enough. The fixture must be designed to *solve* construction problems for architects and builders—rather than to present *new* ones.

So . . . in designing the Miller 2-light Troffer to be the world's finest continuous fluorescent lighting system for offices, stores, schools and industry, we also designed it to be the most practicable to build with—and around.

Therefore . . . the patented Miller Bracket, which makes it possible to hang the troffer from the structural ceiling and then to suspend the false ceiling (either wood or metal frame) *from the troffer.*

This effects construction economies, makes for stronger construction and adds flexibility to the entire installation.

In fact, so versatile is the Miller Troffer —in single units, unit combinations or in continuous light-strips "by the mile" —that its applications are almost as unlimited as the architect's ingenuity.

It is simple to service. It encourages the beneficial use of adequate lighting —an important factor when the wartime bulge in industrial lighting tapers off and new users of fluorescent lighting are needed to fill the gap.

Miller Engineers are in principal cities and, as we work with all light sources, including mercury vapor and incandescent, they are unbiased. So call a Miller Engineer—or call us—and see why The Miller Company starts its *second* hundred years, still in the lead!

THE MILLER COMPANY • MERIDEN, CONNECTICUT

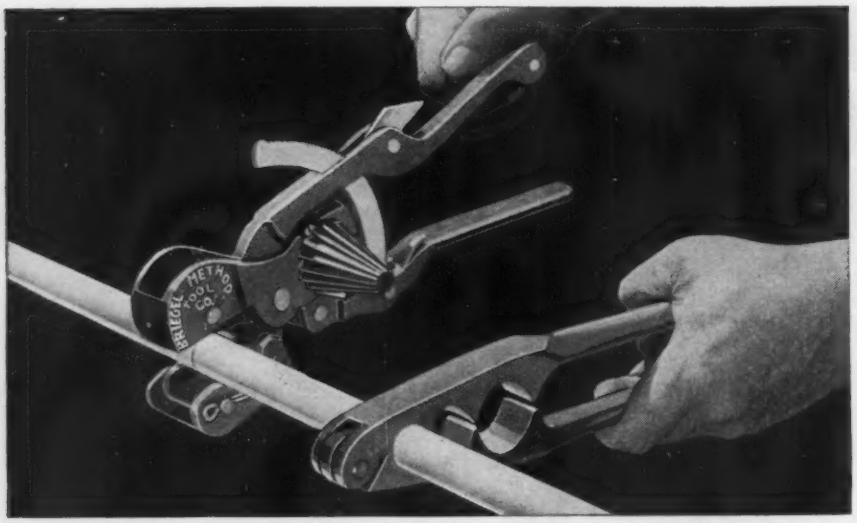
ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844



AUTOMATIC FEED TUBE CUTTER

For ½" to 1" E. M. T. . . .

Cut E. M. T. the quick easy way! Only One Setting. Just clamp the Briegel No. 100 Tube Cutter on the E. M. T. and give it a few turns. No further adjustments necessary. Constant Spring Tension does the rest—gives you a clean cut from the original setting—does away with tube distortion and gives longer cutter life. Then too, the Handy Reamer is attached to it's side. A couple of twists removes any slight inside burr.

HANDY TUBE HOLDER . . .

Also shown is the Briegel Tube Holder that accommodates all sizes of E. M. T. from ½" to 1" without damage to outer coatings.

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The M. B. Austin Co., Chicago, Ill.
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BM TELESCOPE SYSTEM BRIEGEL METHOD TOOL CO. • Galva, Ill.

Tops in Protection

The spectacular production job America is doing is one of the miracles of all time.

TRICO "Powder-Packed" Renewable Fuses and KLIPLOK CLAMPS are contributing a full measure in the drive for producing much more — faster—better—and at LESS COST. The choice of discriminating engineers everywhere because they deliver top-notch efficiency and dependability. You get THREE TIMES THE SERVICE and protect production schedules against unnecessary stoppages.

TRICO KLIPLOKS

Exert a vise-like PRESSURE contact between fuses and clips. The destroying temperatures that cause fuse clips to lose their tension — fuses to become destroyed and blow prematurely — delays and costly repairs, etc. disappear the moment TRICO KLIPLOKS are applied. There's a size for every type of clip.

TRY THIS

FAMOUS TRICO COMBINATION

COAST REPRESENTATIVES

H. H. Van Luven, Los Angeles — Wallace R. Lynn Co., San Francisco
Albert S. Knight, Seattle — W. E. Young Co., Denver

Write for Bulletins 1 and 6

TRICO FUSE MFG. CO. Milwaukee, Wis.

TRADE *notes*

G-E Announces Expansion Plans for West Coast

Continuing its expansion program on the West Coast, General Electric Co. has announced plans for a manufacturing plant at San Jose, Calif., after the war and immediate establishment of a service shop in San Diego.

The manufacturing plant will be located on a 57-acre tract of land south of the San Jose city limits near Pacific Gas and Electric lines and the Southern Pacific main coast line.

The San Diego service shop, planned chiefly to repair battle-damaged equipment and to handle general maintenance requirements for the Navy, is expected to be used postwar for maritime industry needs and for general electrical services. It will be located at 2045 Kettner Blvd. and will be managed by Ralph Meyers, former superintending engineer for G-E at Marinship Corp., on San Francisco Bay.

General Electric's present plants in the West include the Oakland, Calif., works, producing magnet wire, transformers, electric cable and motors; the Oakland lamp factory; the Ontario, Calif., works, which produced appliances before the war but now is turning out war materials; and service shops in San Francisco, Los Angeles, Salt Lake City and Seattle.

● A PLANT for assembling and packing radio and telephonic equipment destined for overseas use is being established in Logan, Utah, by the Wicks Engineering and Construction Co. of Des Moines, Iowa, according to officials of the firm. Equipment will be received from Army service forces depots, unpacked, reassembled where necessary and repacked in corrosion-proof containers for shipment to Pacific war theaters.

● TINLING AND POWELL, Spokane electrical contractors and engineers, have purchased the building of the Inland-American Printing Co., at 706 Sprague Ave., as the beginning of an expansion campaign. Reports were that the building purchased ran into the $20,000 bracket. The company plans to remodel the building and to occupy it soon with enlarged stocks and improved facilities.

● FEDERAL ELECTRIC PRODUCTS CO. has acquired the electrical division of Colt's Patent Fire Arms Mfg. Co., it was announced recently.

● P. F. DIEHL, owner of Diehl Electric Co., wholesaler of electrical supplies, has just announced that as of Sept. 1 he has purchased the Coast Electric Supply Co., of San Francisco, and the combined firm will be known as Diehl Electric with headquarters at 55 Main St., San Francisco. In the merger the entire organization, including the sales staff of Coast Electric Supply, is being taken over into that of Diehl Electric. Eugene P. Schaefer, former owner of Coast Electric Supply, remains for a period of time. The plant is being completely remodeled at the present time. It consists of a building with three floors and basement having 16,000 sq.ft. of space for electrical material. Diehl started an independent wholesale business in 1943. Previous to that he had been with Graybar in New York, Los Angeles and San Francisco for 17 years.

● B. T. ROE, former manager of distribution for the Crosley Corp., has joined the J. N. Ceazen Co. at Los Angeles. He is vice-president and general manager of the firm, which handles a complete line of Crosley products, in addition to tires and other items. Roe was at one time Western sales manager for Crosley and previously had been with the Universal Cooler Corp. and the Leonard Division of the Nash-Kelvinator Corp.

● S & M LAMP CO., Los Angeles, celebrated its 35th anniversary Aug. 9 with the leasing of a third building to add 10,000 sq.ft. of space to its plant facilities. It now has two other plants. An attractive brochure, telling the history of the organization from its founding by James Shirreffs, Sr., with J. W. McFarland, as the S & M Lamp & Radiator Co. in 1909, was distributed to the trade. The company is now managed by the two sons, Jim Shirreffs, Jr. and Wm. G. Shirreffs, who is chief engineer. The company is now exclusively in the manufacture of aluminum floodlights, reflectors and automobile and airplane landing light equipment.

● WALTER E. PARTLOW has opened a repair and service shop at Libby, Montana, under the name of the Partlow Electric Co. As soon as restrictions are lifted, he expects to carry a full line of electric appliances.

WESTERN REPRESENTATIVES
FRED W. CARLSON, Seattle
J. G. CORRIN, Los Angeles
R. F. HAMILTON, Denver
METER SERVICE CO., Salt Lake City

SWITCHES, ENCLOSURES, ACCESSORIES
METER DEVICES COMPANY CANTON, O.

TORK CLOCKS

THE POPULAR TIME SWITCH LINE KNOWN EVERYWHERE

There is a Tork Clock for every regular switching job; 60 minute, 4 hour or daily cycles.

Bulletins on request

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make a *Quicker* contact...

...With Sherman Split Bolt Connectors

Carefully engineered for long wear and lasting grip, Sherman connectors are made of special high-strength bronze alloy. Both body and nut are machine-turned for accurate thread. They are easy to apply to any kind of splice, parallel or tie tap. And they save time and effort by eliminating solder.

Sherman split-bolt connectors are available in either the large head, or the standard head with nut retainer, in sizes to accommodate all standard wires.

MARWOOD LIMITED

SEATTLE . PORTLAND . SAN FRANCISCO . LOS ANGELES

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PROFILES *of the month*

Thirty-one G-E employees in the Utah area became members of the company's Quarter Century Club recently at a banquet in Salt Lake City. Approximately 175 were present to honor the veterans. Shown right are Geo. M. Gadsby (seated left), Utah Power & Light Co. president, who was toastmaster; right, A. L. Jones, G-E Rocky Mountain manager; back, B. C. J. Wheatlake and Jacob Kahn, company officials

Pictured below are wholesalers at the recent meeting of Pacific Division NEWA at Santa Barbara

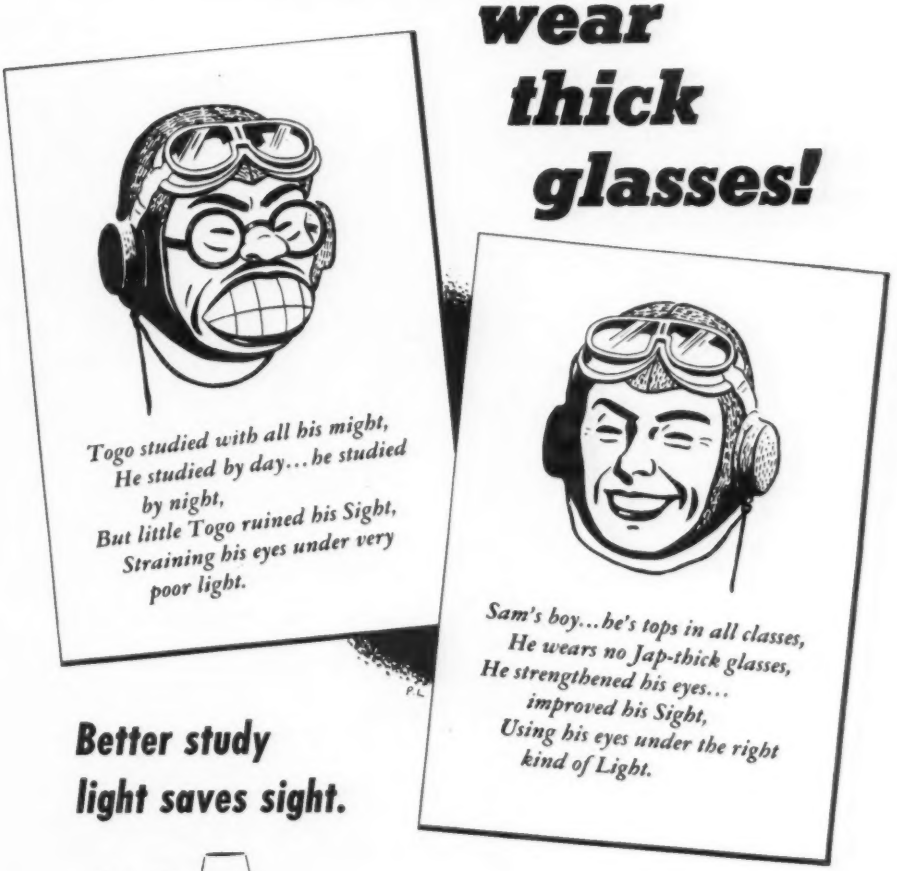
Pictured below at S & M Lamp Co.'s 35th anniversary celebration at Los Angeles: seated, Les Baxter, Portland; Jim Edwards, Vancouver; George Curtiss, Jr., Oakland; Orville Butler, Houston; back, Barney DeRamus, Los Angeles; John Ware, San Diego; George Curtiss, Sr., Oakland; C. D. Cunningham, Seattle; Harry Tanner, Denver; President Jim Shirreffs, Los Angeles; Bill Shirreffs

THE GREAT CONSTRUCTIVE STORY OF "BETTER LIGHT FOR BETTER SIGHT"

CONTINUES TO BE A MAJOR THEME

IN P. G. and E.'s WARTIME ADVERTISING

why JAPS *wear thick glasses!*



Togo studied with all his might,
He studied by day... he studied by night,
But little Togo ruined his Sight,
Straining his eyes under very poor light.

Sam's boy... he's tops in all classes,
He wears no Jap-thick glasses,
He strengthened his eyes... improved his Sight,
Using his eyes under the right kind of Light.

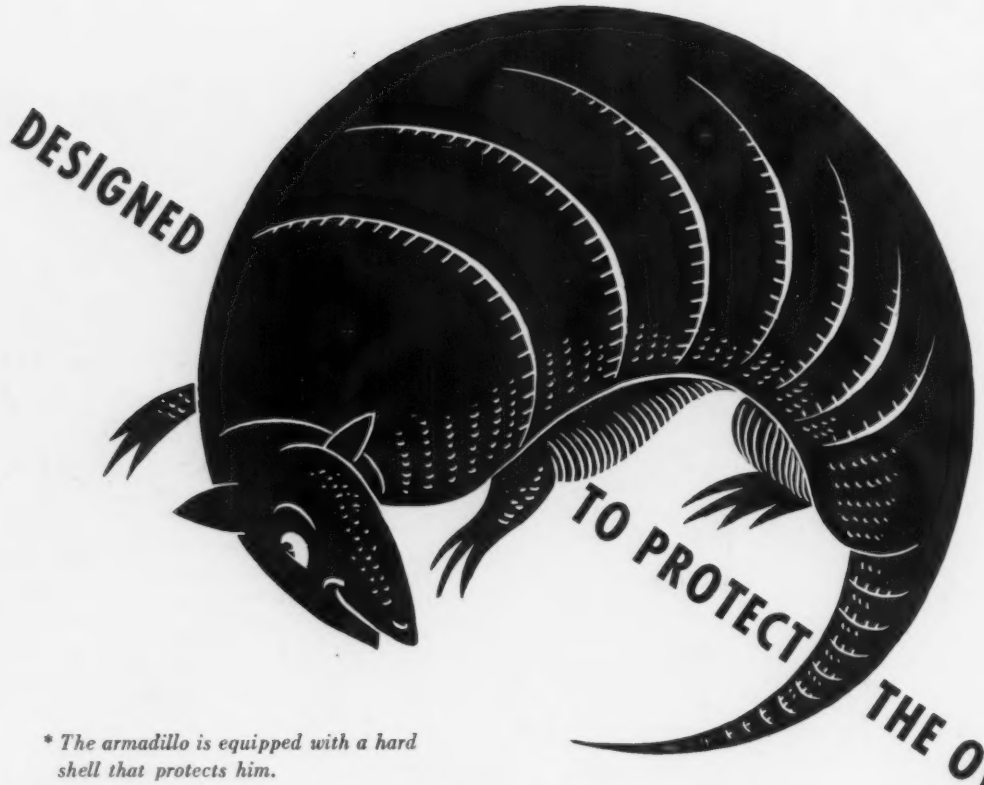
Better study light saves sight.

Remember how we used to advise about Better Light for Better Sight? Thousands of good parents took this advice... gave their boys lamps that made studying easier on the eyes. That good work is paying dividends now. Our American boys shoot faster and more accurately than Japs encumbered with thick glasses. Keep up this good work, parents. For the young ones at home now provide Better Light for Better Study Sight. Good lighting is so cheap it does not pay to skimp it.

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY

THIS ADVERTISEMENT, PART OF THE SEPTEMBER SCHEDULE, WILL RUN IN 309 DAILY AND WEEKLY NEWSPAPERS THROUGHOUT NORTHERN AND CENTRAL CALIFORNIA



* *The armadillo is equipped with a hard shell that protects him.*

Adequate wiring is one of the home owner's surest protections against the danger of his house becoming obsolete before its time. The properly wired home stays modern electrically because every new electrical convenience can be added when desired. The owner is safeguarded against future disappointment in his home's livability, against future loss in its sale value due to lack of electrical facilities. The subject of adequate wiring is one you should be familiar with so that you can properly advise home-planners concerning their wiring needs.

PACIFIC COAST ELECTRICAL ASSOCIATION

601 W. FIFTH STREET, LOS ANGELES 13, CALIF. • 447 SUTTER STREET, SAN FRANCISCO 8, CALIF.